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PHOTOGRAPHIC SOCIETIES.

PHOTOGRAPHIC SOCIETIES OF THE UNITED KINGDOM.

The following list of British Photographic Societies has been compiled from data supplied by their respective Secretaries, except where so indicated. In these instances no information has been received up to the time of going to press.

* Societies marked with an asterisk are affiliated to the Royal Photographic Society.

Aberdeen Photographic Association. — *Pres.*, Alfred J. Wood. *Meetings*, 154, Union Street, Tuesdays, 8 p.m. *Sec.*, James Milne, 38, Elmfield Avenue, Aberdeen.

Aberdeen Photo. Art Club. *Pres.*, John D. Stephen *Meetings*, 220, Union Street, Alternate Thursdays and Fridays from October 24, 8 p.m. *Sec.*, John Rae, 19, St. Nicholas Street, Aberdeen.

Aberdeen Century Camera Club. — *Pres.*, Dr. Thomas Milne. *Sec*, J B. Philip, 8, Belvidere Crescent, Aberdeen.

Accrington Camera Club. —*Pres* , The Mayor. *Meetings*, Market Chambers, Wednesdays, October to March, First Wednesdays, April to September, 7 45 p.m. *Sec.*, John Bonnard, 1, Turkey Street, Accrington.

Accrington.—Wesley Guild Camera Club.—*Pres.*, Geo. Blackledge. *Meetings*, Wesley School, Abbey Street. *Sec.*, W. E. Ellis, 36, Beech Street, Accrington.

***Acton Photographic Society.** - *Pres.*, A. H. C. Hughes. *Meetings*, Churchfield Hall, Second and Fourth Wednesdays, 8 p m., October to May. *Sec.*, W. L Wright, 19, Churchfield Road, East Acton, London, W.

Airdrie.—Monklands Photographic Society.—*Pres.*, Alexander Hay. - *Meetings*, Studio, Victoria Place, Tuesdays, 8 p m *Sec.*, William P. Scobbie, Springwells Cottage, Airdrie.

Altrincham Photographic Society.—*Dead*

Architectural Association Camera Sketch and Debate Club.—*Particulars not received from Secretary.*

Armley and Wortley Photographic Society.—*Pres.*, Dr. T. H. Waddington. *Meetings*, Station Road Mission Room, Armley. Thursdays, 8 p.m *Sec.*, H. Storey, 10, Edinburgh Terrace, Armley, Leeds.

***Ashbourne Photographic Society.**—*Pres.*, A. Gamble. *Meetings*, Albion Rooms, St. John's Street, Second Thursdays, 8 p.m. *Sec.*, H. P. Hansen, Market Place, Ashbourne.

*__Ashford.—Spelthorne Camera Club.__—*Pres.*, Dr. A. Thornton, M.A., LL.D. *Meetings*, National Schools, First and Third Thursdays, 8.30 p.m. *Sec.*, Cyril M. Neaves, School House, Ashford, Middlesex.

Ashton-under-Lyne Photographic Society.—*Pres.*, John W. Kenworthy, J.P. *Meetings*, 147, Stamford Street, Thursdays, 8 p.m. *Sec.*, T. F. Kershaw, Glyn Isa, Smallshaw, Ashton-under-Lyne.

Aston Photographic Society.—*Pres.*, Harold Baker. *Meetings*, Burlington Hall, High Street, Thursdays, 8 p.m. *Ex.*, February. *Sec.*, R. J. Cooper, 86, Witton Road, Aston, Birmingham.

Ayr Amateur Photographic Society.—*Pres.*, I. Terry. *Meetings*, 16, New Bridge Street, First Mondays, 8 p.m. *Ex.*, February. *Sec.*, David Meikle, Parkhouse, Ayr.

*__Balham Camera Club.__—*Pres.*, G. W. Lester. *Meetings*, 268, High Road. Wednesdays, 8.30 p.m. *Sec.*, C. W. I. Stevens, 114, Huron Road, Upper Tooting, London, S.W.

Balham.—Cavendish Camera Club.—*Pres.*, Dr. G. M. Whittingham. *Meetings*, L.C.C. School, Cavendish Road, Alternate Wednesdays, from October 8, 8 p.m. *Sec.*, H. G. Purchase, 69, Honeybrook Road, Balham, London, S.W.

Banbury and District Photographic Society.—*Meetings*, Municipal Technical School, First Mondays, 8 p.m. *Sec.*, Seymour H. Beale, "Caerleon," Banbury.

Barnard Castle and District Amateur Photographic Society.—*Meetings*, Mason's Rooms, 8, Horse Market, Mondays, 8 p.m. *Sec.*, E. Holdsworth, 3, Wilson Street, Barnard Castle.

Barrhead Art Club.—*Pres.*, Rev. Thomas Cook, M.A. *Meetings*, Studio, Water Road, First and Third Wednesdays, 8 p.m. *Sec.*, Robert Colquhoun, 4, Mill Road, Barrhead.

Barrow Naturalists' Field Club (Photographic Section).—*Pres.*, James Frankland. *Meetings*, Cambridge Hall, St. George's Square. Tuesdays, 8.15 p.m. *Sec.*, R. B. Domony, 190, Park Avenue, Barrow-in-Furness.

Barry Y.M.C.A. Camera Club.—*Pres.*, Maj.-Gen. H. H. Lee. *Meetings*, Y.M.C.A., Fridays, 8 p.m. *Ex.*, February. *Sec.*, A. C. Waite, 26, Canon Street, Barry, Glamorganshire.

*__Bath Photographic Society.__—*Pres.*, Rev. Jas. Dunn, M.A. *Meetings*, Royal Institution, Second Tuesdays and Fourth Mondays. *Ex.*, May. *Sec.*, Arthur Coles, Elm Bank, Bloomfield Road, Bath.

Bath and County Camera Club.—*Pres.*, Dr. R. A. Bayliss. *Meetings*, Bath Church Institute, Alternate Wednesdays, from October 8, 8 p.m. *Sec.*, Francis H. Gray, Vine House, Weston, Bath.

Batley Camera Club.—*Pres.*, Whitworth Taylor. *Meetings*, Technical School, Thursdays, 8 p.m. *Sec.*, Charles Henry Giggal, 38, Wellington Street, Batley.

*__Bedford Camera Club.__—*Pres.*, Dr. Harvey Goldsmith. *Meetings*, Newnham Rooms, St. Cuthbert's Street, Mondays, 8 p.m. *Ex.*, March. *Sec.*, E. Blacklock, 7, Albany Road, Bedford.

Beeston Photographic and Art Club.—*Pres.*, Harold Bowden. *Meetings*, Club Rooms, Chilwell Road, Alternate Tuesdays from October 14, 8 p.m. *Sec.*, A. Towlson, Park Street, Beeston Notts.

***Belfast Central Camera Club.** *Pres.*, Jas Gamble. *Meetings*, Assembly Buildings, Second Tuesdays, October to April 8 p.m. *Sec.*, W. J. Rankin, jun., 11, Waring Street, Belfast.

Belfast.—Queen's University Camera Club.—*Pres.*, John Wylie, B.A. *Meetings*, Students' Union, Queen's University, Second Tuesdays, November to March, 8 p.m. *Sec.*, J. D. M. McCallum, 7, Wellington Place, Belfast.

***Belfast City Y.M.C.A. Camera Club.**—*Pres.*, D. W. Elliott. *Meetings*, Y.M.C.A., Wellington Place, First Tuesdays and Second Thursdays, 8 p.m. *Sec.*, H. A. Scott, "Dunraymond," Kingsden Park, Knock Road, Belfast.

***Belmont Camera Club.**—*Pres.*, Charles Radburn. *Meetings* Sherwood House, York Road, Battersea, S.W. *Sec.*, James Parsons, Belmont Works, Battersea, London, S.W.

Bideford Camera Club.—*Pres.*, F. W. Hockaday. *Meetings*, Bridge Chambers, Fridays, 8 p.m. *Sec.*, J. H. Alford, Pengarth, Bideford.

***Birkenhead Photographic Association.**—*Pres.*, E. Newall. *Meetings*, Y.M.C.A., Fridays, 8 p.m. *Sec.*, Verner Bickley, 145, Whetstone Lane, Birkenhead.

***Birmingham Photographic Society.**—*Pres.*, F. A. Biermann. *Meetings*, Exchange Buildings, New Street, Tuesdays, 7.30 p.m. *Ex.*, April. *Sec.*, Philip Docker, Bloomsbury House, Bloomsbury, Birmingham.

Birmingham Field Naturalists' Club.—*Pres.*, W. B. Grove, M.A. *Meetings*, People's Hall, Tuesdays, 7.30 p.m. *Sec.*, Herbert Thompson, 68, Castleford Road, Sparkhill, Birmingham.

Birmingham Municipal Technical School Photographic Society.—*Pres.*, W. J. Ballard. *Meetings*, Technical School, Second and Fourth Saturdays, 7.30 p.m. *Secs.*, H. Fowler, 132, Walford Road, Sparkbrook, Birmingham, and H. J. Shepherd, 48, Dennis Road, Balsall Heath, Birmingham.

Birmingham.—Camp Hill Old Edwardians Photographic Society.—*Pres.*, George H. Ball, M.A. *Meetings*, Camp Hill Grammar School, Mondays, 7.45 p.m. *Ex.*, November. *Sec.*, W. W. Hall, "The Glen," Greenwood Road, Acocks Green, Birmingham.

Birstall Photographic Society.—*Pres.*, Albert Capstick. *Meetings*, Church Institute, alternate Thursdays from September 25, 8 p.m. *Sec.*, William Blakeley, Pharmacist, Birstall, near Leeds.

Bishop Auckland Photographic Society.—*Pres.*, W. Loftus Cummins. *Meetings*, 10, Silver Street, Mondays, 8 p.m. *Sec.*, W. Pickering, 104, Newgate Street, Bishop Auckland.

Blackburn and District Camera Club. *Pres.*, J. J. Masterman. *Meetings*, Church Street, Blackburn. *Sec.*, W. Ernest Balme, 69, Revidge Road, Blackburn.

***Blackpool and Fylde Photographic Society.**—*Pres.*, J. W. P. Loftos. *Meetings*, The White House, Blackpool, Tuesdays, 8 p.m. *Sec.*, A. F. Wilson, 34, Woodland Grove, Blackpool.

Blairgowrie and District Photographic Association. –*Pres.*, Alexander Geekie. *Meetings*, George Street, Blairgowrie, Third Tuesdays, 8.30 p.m. *Sec.*, D S. Maclennan, Marchmont, Blairgowrie.

Blaydon and District Camera Club.—*Pres.*, J. Ritson *Meetings*, Blaydon or Winlaton, First Tuesdays, 7.45 p.m. *Sec.*, W. A. Bagnall, The Groves, Winlaton-on Tyne.

Blyth and District Photographic Society.—*Pres.*, Lord Ridley. *Meetings*, Club House, Lynn Street, Blyth, First and Third Tuesdays, 8 p.m. *Sec.*, W. French, 20, Barnard Street, Blyth.

Bolton Camera Club.—*Pres.*, W. M. Balshaw. *Meetings*, Bradford Buildings, Mawdsley Street, Thursdays, 8 p.m. *Secs.*, W. A. Brunt and G. Holt, Bradford Buildings, Mawdsley Street, Bolton.

Bolton Photographic Society.—*Sec* , C. K. Dalton, 50, Higher Bridge Street, Bolton.

Bootle Amateur Photographic Society.- *Pres.*, W. R. Brewster, J.P. *Meetings*, Central Library, Wednesdays, 8 p.m. *Ex.*, January. *Sec.*, George Collings, 87, Queen's Road, Bootle, Liverpool.

***Borough Polytechnic Photographic Society.**—*Pres.*, W. M. Richardson. *Meetings*, 103, Borough Road, Wednesdays, 8.30 p.m. *Sec.*, Alfred G. Buckham, 103, Borough Road, London, S.E.

Boston Camera Club.—*Pres.*, Dr. C. W. Pilcher. *Meetings*, St. James's Schools, George Street, First and Third Tuesdays, October to April, 8.30 p.m. *Secs.*, H. M. Hames and A. L. Pentelow, 65, West Street, Boston, Lincolnshire.

***Bournemouth Camera Club.**—*Pres.*, Lord Abinger. *Meetings*, Cairns Hall, Alternate Mondays from October 10, 8 p.m. *Ex.*, October. *Sec.*, Miss Penrice, 44, Lowther Road, Bournemouth.

Bournville Camera Club. — *Pres.*, W. Davenport. *Meetings*, Bournville Works, alternate Thursdays from September 18, 7 15 p.m. *Sec.*, A. Ernest Harris, 14, Hawthorne Road, King's Norton, nr. Birmingham.

***Bowes Park and District Photographic Society.** –*Pres.*, Walter Kilbey. *Meetings*, Unity Hall, Wood Green, N., Mondays, October to March: First and Third Mondays, April to September, 8 p.m. *Sec.*, A Allen, Elm Park Road, Winchmore Hill, London, N.

Bradford Photographic Society.—*Pres.*, Ezra Clough. *Meetings* Mechanics' Institute, Mondays, 8 p.m. *Sec.*, W. E. Townend, 14, Manchester Road, Bradford.

Braintree and Bocking Camera Club. –*Meetings*, The Institute. *Sec.*, Edward Fenton, Rayne Road, Braintree.

Brechin Photographic Association. — *Pres.*, Wm. Shaw Adamson. *Meetings*, Mechanics' Institute, Third Wednesdays, 8.15 p.m. *Sec.*, D. M. Watt, 5, Union Street, Brechin.

Brentwood Photographic Society.—*Pres.*, F. F. Renwick. *Meetings*, Boys' Schoolroom, Coptfold Road, First and Third Mondays, 8.15 p.m. *Sec.*, H. F. Hodgson, 60, High Street, Brentwood.

Brierley Hill and District Camera Club.—*Particulars not received from Secretary.*

Brighouse Photographic Society.—*Pres.*, Dr. Geo. A. Farrer. *Meetings*, Studio, Town Hall, Thursdays, 8 p.m. *Ex.*, March. *Secs.* F. W. Crowther, Woodleigh, 13, Old Lane, Brighouse, and Henry Robinson, 6, Edward Street, Clifton, Brighouse.

***Bristol and West of England Amateur Photographic Association.**—*Pres.*, Guy Chilton. *Meetings*, 20, Berkeley Square, Clifton, Second and Fourth Fridays, 7.45 p.m. *Sec.*, E. J. L. Gardiner, 10, Leigh Road, Clifton, Bristol.

***Bristol Photographic Club.**—*Pres.*, John Fisher. *Meetings*, Stuckey's Restaurant, Wine Street, Alternate Wednesdays from October 15, 7.45 p.m. *Sec.*, W. F. Kuner, 62, Arley Hill, Bristol.

***Bromley (Kent) Camera Club.**—*Meetings*, Literary Institute, alternate Fridays from October 17, 8 p.m. *Sec.*, T. Arnold Bennett, 24, Widmore Road, Bromley, Kent.

Burnley Photographic Society.—*Pres.*, Joseph Walton. *Meetings*, Turf Street, Tuesdays, 7.30 p.m. *Sec.*, Joseph Murtagh, 140, Brunshaw Road, Burnley.

Burnley Mechanics Institution Camera Club.—*Pres.*, Rev. A. Gray. *Meetings*, Mechanics Institution, Thursdays, 7.45 p.m. *Ex.*, February. *Sec.*, F. C. Hall, 353, Padiham Road, Burnley.

Bury.—Y.M.C.A. Amateur Photographic Society.—*Pres.*, T. W. Gregory. *Meetings*, Y.M.C.A., Stanley Street, Tuesdays, 7.45 p.m. *Sec.*, James Spencer, 100, Bury Street, Heywood, Lancs.

Bury Athenæum Photographic Society.—*Dead.*

Bury St. Edmund's Camera Club.—*Pres.*, A. G. Bristow. *Meetings*, Y.M.C.A. Building, First Tuesdays, 8.30 p.m. *Sec.*, Alfred E. Wiggin, 15, Brentgovel Street, Bury St. Edmund's.

***Cambridge and District Photographic Club.**—*Pres.*, F. J. Stoakley. *Meetings*, 12, Park Place, Bridge Street, Tuesdays, October to June, 8.30 p.m. *Sec.*, T. J. Sowdon, Sunny Side, Guest Road, Cambridge.

Cambuslang Camera Club.—*Pres.*, David Ireland. *Sec.*, Gavin Ferguson, 14, Bank Street, Cambuslang.

Camera Club, The.—*Meetings*, 17, John Street, Adelphi, W.C., Thursdays, 8.30 p.m. *Sec.*, H. Philp, 17, John Street, Adelphi, London, W.C.

***Canterbury Camera Club.**—*Pres.*, Dr. R. Graham Wills. *Meetings*, Gaywood's Rooms, Alternate Mondays, from September 29, 8.30 p.m. *Sec.*, O. G. Dixon, Ivy Lodge, North Lane, Canterbury.

Cardiff Camera Club.—*Pres.*, I. J. Chorley. *Meetings*, Y.M.C.A., Fridays, 8 p.m. *Sec.*, C. H. Carder, Grangetown Gas Works, Cardiff.

Cardiff Naturalists' Society (Photographic Section).—*Pres.*, Dr. P. Rhys Griffiths. *Meetings*, 5, High Street, Second Tuesdays, 8 p.m. *Sec.*, Gilbert D. Shepherd, Gresham Chambers, Kingsway, Cardiff

***Carlisle and County Amateur Photographic Society.**—*Pres.*, John Robson. *Meetings*, Tullie House, Wednesdays, 8 p.m. *Sec.*, S. W. B. Jack, 19, Lowther Street, Carlisle.

arlisle.—Liberal Border City Camera Club.—*Pres.*, John Hunter. *Meetings*, Liberal Club, Lowther Street, Alternate Wednesdays, from November 5, 8 p.m. *Sec.*, John Robinson, 37, Warwick Road, Carlisle.

Carnoustie Photographic Association. *Particulars not received from Secretary.*

Castlebar Camera Club.—*Particulars not received from Secretary.*

***Catford and Forest Hill Photographic Society.** *Pres.*, Major Sir E. F. Coates, Bart., M.P. *Meetings*, Dartmouth Hall, Forest Hill, First and Third Mondays, 8 30 p m. *Sec.*, William Theyer Browne, 73, Silverdale, Sydenham, London, S.E.

***Central Y.M.C.A. Photographic Society.**—*Pres.*, J. C S. Mummery. *Meetings*, Y.M C.A., Tottenham Court Road *Sec.*, Henry Rigby, Central Y.M.C A., Tottenham Court Road, London, W.C.

***Chelmsford Photographic Society.**—*Pres.*, The Mayor. *Meetings*, 113, London Road, Mondays, 8 p.m. *Sec.*, H. Breach, Broadlands, Lady Lane, Chelmsford.

***Chelsea and District Photographic Society.**—*Pres.*, F. Humpherson. *Meetings*, South-Western Polytechnic, Manresa Road, Chelsea, Alternate Thursdays, from October 2, 8 p.m. *Sec.*, L. H. Powers, 18, Glebe Place, Chelsea, London, S.W.

***Cheltenham Amateur Photographic Society.**—*Meetings*, 1, Imperial Square, Alternate Wednesdays, from October 29, 8 p.m. *Sec.*, A. H. Smithson, "Rydal," Hewlett Road, Cheltenham.

***Cheltenham College Photographic Society.** - *Pres.*, C. E. Youngman, M.A. *Meetings*, College Physics Laboratory. *Sec.*, R. M. Towers, M.A., 7, Oriel Place, Cheltenham.

***Chester Society of Natural Science (Photographic Section).** —*Pres.*, Frank Simpson. *Meetings*, Grosvenor Museum, Third Fridays. *Sec.*, P. H. Okell, 1, Northgate Street, Chester.

Chester Y.M.C.A. Camera Club.—*Pres*, T. C. Johnson. *Meetings*, St. John's House, First Thursdays, 8 p.m. *Sec.*, Albert E. Matthews, St John's House, Chester.

Chichester Photographic Society. *Pres.*, F. B. Tompkins, *Meetings*, Technical Institute, Second Tuesdays, 8.15 p m. *Sec.*, J. W. Barnes, Clyde House, Chichester.

***Chislehurst Photographic Society.**- *Pres.*, Rev James Dawson, M.A. *Meetings*, Society's Rooms, Crown Lane, alternate Mondays, 8.30 p.m. *Sec.*, Miss A. J. Dawson, The Rectory, Chislehurst.

Chorley Photographic Society.—*Pres*, Richard Gill. *Meetings*, Library Street, Wednesdays (monthly), 7.30 p.m. *Sec.*, H. R. Dorning, 8, Pall Mall, Chorley, Lancs.

***City of London and Cripplegate Photographic Society.**—*Pres.*, Newman F. Horne. *Meetings*, Cripplegate Institute, Second and Fourth Mondays, October to May, 7.30 p.m. *Ex.*, October. *Sec.*, Frank W. Gardner, 135, Vaughan Road, Harrow.

City and Guilds (Engineering) College Photographic Society.—*Particulars not received from Secretary.*

Clapham Carlton Camera Club.—*Pres.*, Major Frank Johnson. *Meetings*, Clapham Carlton Club, Irregular, 8.30 p.m. *Sec.*, Frank Styles, 31, Englewood Road, Clapham Common, London, S.W.

Cleveland Camera Club—*Pres.*, J. J. Burton. *Meetings*, The Studio, Clarendon Road, Middlesbrough, Mondays, from October 6. *Sec.*, Arnold Bennett, Springroyd, The Avenue, Linthorpe, Middlesbrough.

Coatbridge Photographic Association.—*Pres.*, Robert H. Hobbs. *Meetings*, Carnegie Library, Second and Fourth Thursdays, 8 p.m. *Sec.*, William McAnsh, 3, Albany Street, Blairhill, Coatbridge.

Coatbridge Co-operative Camera Club.—*Pres.*, John Thom. *Meetings*, Library Hall, First Mondays, 8 p.m. *Sec.*, William Bell, 29, Alexander Street, Coatbridge.

Colne Camera Club.—*Pres.*, J. J. Hartley *Meetings*, Vivary Buildings, Fridays, 8 p.m. *Sec.*, J. H. Kay, 107, Langroyd Road, Colne, Lancs.

***Constitutional Club Employees Camera Club.**—*Pres.*, F. M. Remnant *Meetings*, Constitutional Club. *Sec.*, A. C. Webster, Constitutional Club, Northumberland Avenue, London, W.C.

Cornish Camera Club.—*Pres.*, R. Pearce Couch. *Meetings*, The Studio, Penzance. *Sec.*, Henry Stewart, 6, Causewayhead, Penzance

Cornwall Royal Polytechnic Society.—*Pres.*, Lord St. Levan, *Meetings*, Polytechnic Hall, Falmouth, First Tuesdays, 3.30 p.m. *Sec.*, E. W. Newton, 4, Cross Street, Camborne, Cornwall.

***Coventry Photographic Club.**—*Pres.*, A. H. Niblett. *Meetings*, 7, Little Park Street, Wednesdays, 8 p.m. *Sec.*, G. O. Seymour, 56, Holyhead Road, Coventry.

***Cowes Camera Club.**—*Particulars not received from Secretary.*

Cowlairs Co-operative Camera Club.—*Pres.*, Robert Scott. *Meetings*, 264, Springburn Road, Glasgow, Last Fridays, 8 p.m. *Ex.*, February. *Sec.*, Alex. Porter, 70, Keppochhill Road, Glasgow.

***Croydon Camera Club.**—*Pres.*, F. J. Torry. *Meetings*, 128A, George Street, Wednesdays, 8 p.m. *Sec.*, W. H. Claypoole, B.A., 21, Acacia Grove, West Dulwich, London, S.E.

Culcheth Camera Club.—*Pres.*, M. H. Kenyon. *Meetings*, Culcheth School, Newton Heath, Third Mondays, 8 p.m. *Sec.*, A. Lindley, 20, Derbyshire Road, Clayton Bridge, Manchester.

Cwmaman Photographic Society.—*Pres.*, William Thomas. *Meetings*, The Institute, Alternate Wednesdays, from October 8 7.30 p.m. *Sec.*, James Williams, 11, Railway Row, Cwmaman.

Darwen Photographic Association.—*Pres.*, J. W. Smith. *Meetings*, Arch Street, Thursdays, 8 p.m. *Sec.*, John Totty, 12, Sunnyhurst Lane, Darwen.

Dennistoun Amateur Photographic Association.—*Pres.*, Wm. Robb Taylor. *Meetings*, 27, Hillfoot Street, Wednesdays, 8 p.m. *Ex.*, April. *Sec.*, John Macdonald, 135, Hill Street, Dennistoun, Glasgow.

***Derby Photographic Society.**—*Pres.*, Rev. Canon Wild. *Meetings*, Grand Jury Room, Town Hall *Sec.*, E. Collier Green, 27, Friar Gate, Derby.

Derby.—Midland Railway Institute Photographic Society. *Pres.*, Major L. Sandwith. *Meetings*, M.R. Institute, First Mondays, October to March, 7.30 p.m. *Ex.* March. *Sec.*, William Smithard, C.M.E. Department, Midland Railway, Derby.

Dewsbury Photographic Society.—*Pres.*, Albert Lyles. *Meetings*, Central Liberal Club, Bond Street, Mondays, October to March, 8 p.m. *Sec.*, Joseph Garside, 45, Healds Road, Dewsbury.

***Doncaster Camera Club.**—*Pres.*, W. Roberts. *Meetings*, New Science Room, Guild Hall, Second and Fourth Tuesdays, September to March, 8.15 p.m. *Sec.*, John T. Blackshaw, 52, Spansyke Street, Doncaster.

Dover Institute Photographic Society.—*Pres.*, Ernest Pain. *Meetings*, The Institute, Second Thursdays 8.30 p.m. *Sec.*, Chas. C. Marsh, 7, High Street, Dover.

Dublin Camera Club. *Particulars not received from Secretary.*

Dublin—Atlas Scientific Club.—*Dead*

Dukinfield Photographic Society.—*Pres.*, H. L. Hadfield. *Meetings*, Co-operative Hall, Wednesdays, 8.30 p.m. *Sec.*, J. W. Carey Titterington, 28, Old Road, Dukinfield.

Dulwich College Science and Photographic Society.—*Pres.*, J. A. Stedman. *Meetings*, Dulwich College, Fridays, 7 p.m. *Ex.* October. *Sec.*, W. E. Armstrong, Dulwich College, London, S.E.

Dumbarton Co-operative Camera Club.—*Pres.*, Wm. Craig, *Meetings*, 46, High Street, First and Third Tuesdays, 7.30 p.m. *Sec.*, James Balfour, Ivydene, Oxhill Road, Dumbarton.

Dumbarton.—Denny Institute (Photographic Section).—*Pres.*, Sir Arch. Denny, LL.D. *Meetings*, Denny Institute, Alternate Mondays, 8 p.m., from October 27. *Sec.*, Robt. M. Fortune, Photographic Laboratory, Leven Shipyard, Dumbarton.

Dumfries Natural History Society (Photographic Section). *Particulars not received from Secretary.*

***Dundee and East of Scotland Photographic Association.**—*Pres.* Vaness C. Baird. *Meetings*, University College, Dundee, First Thursdays November to April, 7.45 p.m. *Sec.*, James Slater, Jr., Panmure Villa Lodge, Broughty Ferry.

Durham City Camera Club.—*Pres.*, John Morson. *Meetings*, North of England Café, Wednesdays, 7.30 p.m. *Sec.*, Arthur E. Thwaites, Camborne House, The Avenue, Durham.

***Ealing Photographic Society.**—*Pres.*, G. B. Clifton. *Meetings*, Town Hall, First and Third Wednesdays, October to March, 8 p.m. *Sec.*, T. W. Bartlett, 20, Craven Avenue, Ealing.

***Eastbourne Natural History Society (Photographic Section).**—*Pres.*, F. Bolton Sutton. *Meetings*, Technical Institute, Fourth Thursdays, 8.15 p.m. *Sec.*, Albert J. Fellows, 7, Susans Road, Eastbourne.

***East Kent Scientific and Photographic Society.**—*Pres.*, Dr. Graham Wills. *Meetings*, Beasey Institute, Second Tuesdays, 8 p.m. *Sec.*, A. Lander, 17, High Street, Canterbury.

Edgworth and District Photographic Society.—*Pres.*, Major Booth, J.P *Meetings*, Edgworth Institute, Mondays, 7.30 p.m. *Sec.*, Herbert Whitehead, Edgworth, near Bolton.

Edinburgh Photographic Society.—*Pres.*, R. Berry. *Meetings*, 38, Castle Street, First Wednesdays, 8 p.m. *Sec.*, Wm. Miller Drummond, 17, Duke Street, Edinburgh.

Edinburgh Photographic Club.—*Pres.*, Robert Berry. *Meetings*, 38, Castle Street, Third Wednesdays, 8 p.m. *Sec.*, T. Barclay, 26, Blackford Avenue, Edinburgh

Edinburgh.—Heriot Camera Club.—*Pres.*, R. J. Ritchie, M.A., B.Sc. *Meetings*, George Heriot's School, Second Fridays, 8 p.m. *Sec.*, W. H. Cameron, George Heriot's School, Edinburgh.

***Epsom Literary and Scientific Society (Photographic Section).**—*Meetings*, Committee Room, Public Hall, Monthly in Winter. *Sec.*, J. L. Lempriere, 6, Castle Cottages, Epsom.

Erdington Photographic Society.—*Pres.*, Thos. A. Sands. *Meetings*, The Church House, Mondays, 8 p.m. *Sec*, Alex. P. Campbell, 21, Oakfield Road, Erdington, Birmingham.

Everton Camera Club.—*Pres.*, G. J. Drysdale. *Meetings*, 14, Village Street, Tuesdays, 8 p.m. *Sec.*, William A. Mackie, 7, Wharncliffe Road, Stoneycroft, Liverpool.

Exeter Camera Club.—*Pres.*, J. H. Lake. *Meetings*, The Barnfield. *Sec.*, Albert J. Tucker, 21, Cathedral Yard, Exeter.

***Fakenham Literary, Field, and Camera Club.**—*Pres.*, A. Digby, M.A. *Meetings*, Lecture Hall, Tuesdays, 8 p.m. *Sec.*, J. C. Holton, Fakenham.

Faversham Institute Photographic Society.—*Pres.*, Captain C. F. Hooper. *Meetings*, The Institute, East Street, Third Tuesdays, 8.15 p.m. *Sec.*, Wm. Whiting, Ospringe, Faversham.

Fenton Photographic Society.—*Pres.*, James I. Myatt. *Meetings*, Heron Cross Council Schools, First Thursdays, September to May, 7.45 p.m. *Sec.*, S. G. Challinor, 113, High Street, Fenton, Staffs.

***Folkestone and District Camera Club.**—*Pres.*, Alderman F. Hall, J.P. *Meetings*, Technical Institute, First and Third Thursdays, 8.15 p.m. *Sec.*, H. Wheeler, Church Street, Folkestone.

***Forest Gate Camera Club.**—*Dead.*

Gateshead and District Camera Club.—*Pres.*, Councillor Robert Wilson. *Meetings*, 99, Windsor Avenue, Gateshead, Wednesdays, 8 p.m. *Ex.*, March. *Sec.*, Ralph Dickman, 206, Prince Consort Road, Gateshead.

***Glasgow and West of Scotland Amateur Photographic Association.**—*Pres.*, W. R. Baxter. *Meetings*, 180, West Regent Street, Glasgow, First and Third Mondays, 8 p.m. *Sec.*, Gilbert S. McVean, 125, West Regent Street, Glasgow.

Glasgow Eastern Photographic Association.—*Pres*, James Robin. *Meetings*, 12A, Landressy Street, Thursdays, 8 p.m. *Sec.*, Andrew Patrick, 12A, Landressy Street, Bridgeton, Glasgow.

Glasgow Eastern Co-operative Camera Club.—*Particulars not received from Secretary.*

Glasgow (South) Camera Club.—*Pres.*, W. C. S. Fergusson. *Meetings*, 43, Bankhall Street, Govanhill, Tuesdays, 8.15 p.m. *Sec.*, John Baird, 6, Boyd Street, Crosshill, Glasgow.

Glasgow.—Corporation Electric Tramways Camera Club. —*Pres.*, Robert Lawson. *Meetings*, Partick Depot *Sec.*, James A. B. Harley, 65, Dumbarton Road, Partick, Glasgow.

Glasgow.—St. George Co-operative Society Camera Club. —*Pres.*, Robert Park. *Meetings*, 40, Gladstone Street, Alternate Mondays, from October 6, 8 p.m. *Sec.*, A. J. Galt, 1, Woodburn Place, Kelmhaugh Street, Glasgow.

Glasgow.—St. Rollox Co-operative Camera Club. —*Particulars not received from Secretary.*

Glenalmond Photographic Club.—*Particulars not received from Secretary*

Glossop Dale Photographic Society.—*Pres.*, J. Merry. *Sec.*, T. W. Sharpe, 85, Primrose Terrace, Glossop.

Gloucestershire Photographic Society.—*Pres.*, H. Knowles. *Meetings*, Technical Schools, First and Third Tuesdays, 8.15 p.m. *Sec.*, Chas. J. Scott, Hasfield, near Gloucester.

Govan-Kinning Park Co-operative Camera Club.—*Pres.*, Wm. C. Stark. *Meetings*, 6, Langlands Road, Alternate Wednesdays, from October 8, 8 p.m. *Sec.*, Peter Orr, 3, Alexandria Terrace, Govan.

Govan Y.M.C.A. Photographic Society. — *Particulars not received from Secretary.*

Grange (Cheshire) Photographic Club. — *Particulars not received from Secretary.*

Grangemouth Amateur Photographic Association.—*Pres.*, G. V. Morrison. *Meetings*, Y.M.C.A., First and Third Thursdays. *Sec.*, Robert Marshall, 3, Park Terrace, Grangemouth.

Grange-over-Sands Literary and Scientific Society (Photographic Section). — *Pres.*, Rev. Ivor G. Farrar. *Meetings*, Victoria Hall, First and Third Tuesdays, 8 p.m. *Sec.*, Rev. Geo. Vickars-Gaskell, Prospect Villa, Grange-over-Sands, Lancashire.

Grantham Photographic Society.—*Pres.*, Dr. H. Poole-Berry. *Meetings*, Museum, Guildhall, First and Third Tuesdays, October to April, 8 p.m. *Sec.*, J. G. Bothamley, 22, Gladstone Terrace, Grantham.

Graphic Society, Plymouth.—*Pres.*, G. F. Treleaven. *Sec.*, I. S. Hawker, Mutley House, Plymouth.

***G.W.R. Literary Society (Photographic Section).**—*Pres.*, Col. the Hon. C. E. Edgcumbe. *Meetings*, 44, Eastbourne Terrace, Paddington, W., Alternate Tuesdays. *Sec.*, C. E. Smith, 44, Eastbourne Terrace, W.

Greenock Camera Club.—*Pres.*, Alexander Niven. *Meetings*, 21, Kilblain Street, Thursdays, 8 p.m. *Sec.*, John Flockhart, 28, Nicolson Street, Greenock.

***Grimsby and District Camera Club.**—*Pres.*, Herbert Johnson. *Meetings*, School of Art, Second Thursdays, 8 p.m. *Sec.*, Alfred S. Still, 216, Convamore Road, Grimsby.

***Guernsey Photographic Society.**—*Pres.*, H. C. Le Messurier. *Meetings*, Guille-Allés Library, First Mondays (winter), First Thursdays (summer), 8 p.m. *Sec.*, Miss Mabel A. Randell, Grove End, Doyle Road, Guernsey.

Guisborough Fine Art and Industrial Society—*Pres.*, W. Charlton, J.P. *Meetings*, Mechanics' Institute. *Sec.*, George Page, 34, Westgate, Guisborough.

***Guy's Hospital Nurses' Photographic Society.**—*Pres.*, Miss L. V. Haughton. *Meetings*, Nurses' Home, Guy's Hospital. *Sec.*, Miss M. Smith, Guy's Hospital, London, S.E.

***Hackney Photographic Society.**—*Pres.*, J. J. Beasley. *Meetings*, Hackney Baths, Tuesdays, 8 p.m. *Ex.*, November. *Sec.*, Walter Selfe, 24, Pembury Road, Clapton, London, N.E.

Halifax Camera Club.—*Dead.*

Hallside Co-operative Camera Club. *Pres.*, Alexander Aird. *Meetings*, Victoria Hall, Alternate Tuesdays from January 13. 7.30 p.m. *Sec.*, William Boyd, 58, Hallside, Newton, near Glasgow.

Hamilton Natural History and Photographic Society.—*Pres.*, James Ellis. *Meetings*, Public Library, First and Second Tuesdays, 8 p.m. *Ex.*, March. *Sec.*, William Frame, Windmill Road, Hamilton.

***Hammersmith—Hampshire House Photographic Society.**—*Pres.*, G. Hawkins. *Meetings*, Hampshire House, Thursdays, 8 30 p.m. *Sec.*, M. O. Dell, 431, North End Road, Walham Green, London, S W.

***Hampstead Photographic Society.**—*Pres.*, Professor W. M. Flinders Petrie. *Meetings*, Stanfield House, Prince Arthur Road, Second Wednesdays, 8 45 p.m. *Sec.*, H. Nevil Smart, 3, Northwick Terrace, St. John's Wood, London, N.W.

Hampstead Garden Suburb Photographic Society.—*Pres.*, Sir Benjamin Stone. *Meetings*, The Institute, Garden Suburb, Second Fridays, 8.15 p.m. *Sec.*, J. S. Rathbone, The Institute, Central Square, Hampstead Garden Suburb, London, N.W.

Handsworth Photographic Society.—*Pres.*, Philip Whitehouse. *Meetings*, 20, Soho Road, Thursdays, 8 p.m. *Sec.*, A. E. Teague, 67, Whitehall Road, Handsworth, Birmingham.

Hanley Photographic Society (Y.M.C.A.).—*Pres.*, Jas. Wright. *Meetings*, Y.M.C.A. Rooms, Tuesdays, 7.30 p.m. *Secs.*, G. T. Boulton, 125, Gilman Street, Hanley; and W. T. Walley, 59, St. John's Street, Hanley.

Hartlepools Photographic Society.—*Pres.*, F. Yeoman. *Meetings*, Technical College, West Hartlepool, alternate Wednesdays, 7.30 p.m. *Sec.*, R. S. Bowman, 23, Welldeck Road, West Hartlepool.

Hastings—East Sussex Arts Club.—*Pres.*, A. W. Strutt. *Meetings*, Lower Public Hall, Hastings. *Sec.*, W. J. Watson. "Woodleigh," St. Helen's Park Road, Hastings.

Hebden Bridge Photographic Society.—*Pres.*, Sam. Greenwood. *Meetings*, Secondary School, Second and Fourth Saturdays, 7 p.m. *Sec.*, Edward B. Gibson, Croft Terrace, Hebden Bridge.

Henley-on-Thames Y.M.C.A. Amateur Photographic Society.—*Meetings*, Y.M.C.A., First Mondays, 9 p.m. *Ex.*, November. *Secs.*, E. Dudley and S V Road, Y M C A, Henley-on-Thames

Herefordshire Photographic Society.—*Pres.*, Walter Pilley. *Meetings*, 76, Eign Street, Hereford, First Tuesdays, 8 15 p m *Sec.*, Cecil Gethen, 9, St. Nicholas Street, Hereford.

Horwich Institute Amateur Photographic Society.—*Pres.*, G. Hughes *Meetings*, Mechanics' Institute, Wednesdays, 8 p m *Sec*, Joseph McKernan, 27, Webb Street, Horwich.

***Hove and Brighton Camera Club.**—*Pres.*, William White Palmer. *Meetings*, 4A, Castle Square, Brighton, Second and Fourth Mondays, 8 30 p.m. *Sec.*, Miss Amy Frinneby, 23, The Drive, Hove.

Hucknall and District Photographic Society.—*Particulars not received from Secretary.*

Huddersfield Naturalist and Photographic Society.—*Pres.*, Fred Lee. *Meetings*. Technical College, Alternate Thursdays, from October 4, 7.30 p.m *Sec.*, A. C. Ellis, Almondbury, Huddersfield.

Hull Photographic Society.—*Pres.*, J T Dyson. *Meetings*, Grey Street, Tuesdays, 8 p.m *Sec.*, H. Holtby, 168 Clumber Street, Hull.

***Ibis Camera Club.**—*Pres.*, T. C. Dewey. *Meetings*, 142, Holborn Bars. *Sec.*, E. F. Simons, 66, Old Road West, Gravesend.

Idlers' Camera Club.—*Pres.*, Roderick J. Fry. *Meetings*, Union Street, Bristol. *Sec.*, Chas. Crocker, 97, Sefton Park Road, Bristol.

***Ilford Photographic Society.**—*Pres.*, T. M. Weaver. *Meetings*, Cecil Hall, Wednesdays, October to April, 8 p.m. *Sec.*, R. Whittingham, 20, Norfolk Road, Seven Kings, Ilford, Essex.

Ilkeston Arts Club.—*Pres.*, The Mayor. *Meetings*, Free Library, First Fridays, 8 p.m. *Ex.*, April. *Sec.*, Arthur Smith, "Ashville," Catherine Avenue, Ilkeston.

Ipswich Camera Club.—*Dead.*

***Ipswich Scientific Society.**—*Pres.*, F. Canton. *Meetings*, The Museum, First Wednesdays, 8 p.m. *Sec.*, H. De Boer, 93, London Road, Ipswich.

***Ipswich Social Settlement Camera Club.**—*Pres.*, Sir Daniel F. Goddard, M.P. *Meetings*, Social Settlement, Fore Street, Alternate Mondays, from September 15, 8 p.m. *Sec.*, Fredk. G. Mallett, "Montgomery," Bishops Hill, Ipswich.

***Isle of Man Camera Club.**—*Pres.*, W. Beck *Meetings*, 61, Buck's Road, Douglas, Alternate Tuesdays, 8 p.m. *Ex.*, December. *Sec.*, T. S. Qualtrough, 76, Buck's Road, Douglas, Isle of Man.

***Isle of Wight Photographic Society.**—*Meetings*, Quay Street, Newport, First and Third Wednesdays, 8 p.m. *Sec.*, R. Crowhurst, 48, High Street, Newport, I W.

Keighley and District Photographic Association.—*Pres.*, M. S. Dean. *Meetings*, Mechanics' Institute, irregular, 7.30 p.m. *Sec.*, R. Warnes, 7, Low Street, Keighley.

***Kennaway Photographic Society.**—*Pres.*, the Rev. Prebendary H. E. Fox. *Meetings*, 16, Salisbury Square, E.C., Fourth Tuesdays, 6 p.m. *Secs.*, W. R. C. Cooke and J. F. Young, 16, Salisbury Square, London, E.C.

Kettering Photographic Society.—*Pres.*, T. G. Fraser. *Meetings*, Church Institute, as arranged, 8 p.m. *Sec.*, Ernest Claypole, 112, Hawthorn Road, Kettering.

Kidderminster and District Photographic Society.—*Pres.*, W. H. Witherby, M A. *Meetings*, rear of 21, High Street, October to April, Alternate Mondays, from October 13, 8.15 p.m. *Sec.*, H. W. West, 12, Birmingham Road, Kidderminster.

***Kingston-on-Thames and District Photographic Society.**—*Pres.*, Dr. A. Dashwood Howard. *Meetings*, Free Library, Kingston-on-Thames, Mondays, October to March, 8.15 p.m. *Sec.*, Albert J. P. Hayes, "Avondale," Birkenhead Avenue, Kingston-on-Thames.

King William's College Photographic Society.—*Pres.*, J. D. Paul. *Meetings*, King William's College. *Sec.*, A. H. Sewell, King William's College, Castletown, Isle of Man.

Kirkcaldy Photographic Society.—*Pres.*, A. B. Young. *Meetings*, Pet Marjorie's House, High Street, Second Tuesdays, 8 p.m. *Sec.*, W. W. Hutchison, 35, David Street, Kirkcaldy.

Kirkintilloch Amateur Photographic Association.—*Pres.*, Robert Smith. *Meetings*, Club Room, Broadcroft, Last Mondays, 8.15 p.m. *Sec.*, John V. McLellan, 69, Cowgate, Kirkintilloch.

Lancaster Photographic Society.—*Pres.*, R. T. Simpson. *Meetings*, Stonewell, Mondays, 8 p.m. *Sec.*, George E. Scott, 6, Northumberland Street, Morecambe.

Larkhall Camera Club.—*Particulars not received from Secretary.*

Leeds Camera Club.—*Pres.*, Robert Bellis. *Meetings*, Leeds Institute, Cookridge Street, Mondays, 8 p.m. *Sec.*, Ernest A. Crick, "Oakfield," Crossgates, near Leeds.

Leeds Photographic Society.—*Pres.*, Thomas W. Thornton. *Meetings*, Leeds Institute, Cookridge Street, Tuesdays, 8 p.m. *Sec.*, Harold Bradley, St. Andrew's Avenue, Morley, near Leeds.

Leek Photographic Society.—*Pres.*, J. Hall, J.P. *Meetings*, Alexandra Club, Mondays and Thursdays, 8 p.m. *Sec.*, H. Mottershead, 41, St. Edward Street, Leek.

***Leicester and Leicestershire Photographic Society.**—*Pres.*, W. T. Mason. *Meetings*, Oriental Café, Market Place, Leicester, Wednesdays, 8 p.m. *Sec.*, Chas. Wm. Loake, 2A, Dulverton Road, Leicester.

Leicester Literary and Philosophical Society (Section G, Photography).—*Pres.*, J. T. Craig. *Meetings*, Council Room, Museum, Second and Fourth Tuesdays, 8 p.m. *Sec.*, W. Bailey, 15B, Cank Street, Leicester.

Leigh (Lancs.) Photographic Society.—*Pres.*, W. Hampson. *Meetings*, over Co-operative premises, Railway Road, Alternate Thursdays from October 2, 8.15 p.m. *Sec.*, A. L. Makinson, Landside, Beech Walk, Leigh, Lancs.

Leith Amateur Photographic Association.—*Pres.*, George Cleland. *Meetings*, 6, Charlotte Street, Second Tuesdays, 8 p.m. *Sec.*, Robert Knowles, 6, Charlotte Street, Leith.

Lewes Photographic Society.—*Pres.*, G. J. Wightman. *Meetings*, Town Hall, First Tuesdays, 8.15 p.m. *Sec.*, F. W. Davey, Moat Cottage, St. Michaels, Lewes.

Lewisham Y.M.C.A. Camera Club.—*Meetings*, Y.M.C.A., first Mondays, 8.30 p.m. *Sec.*, W. Francis, 25, Gilmore Road, Lewisham, London, S.E

Lincoln Amateur Photographic Society.—*Pres.*, R. C. Minton. *Meetings*, Board Room, Newland, Fridays, 8 p.m. *Ex.*, April. *Sec.*, W. Otter, 12, Broadgate, Lincoln.

***Liverpool Amateur Photographic Association.**—*Pres*, C. F. Inston. *Meetings*, 9, Eberle Street, Thursdays, 7.45 p.m. *Sec.*, Alex. W. Duncanson, B.Sc., 9, Eberle Street, Liverpool.

Liverpool Central Y.M.C.A. Camera Club.—*Pres.*, F. O. Creswell. *Meetings*, Y.M.C.A., Mount Pleasant. *Sec.*, J. Graham, 26, Alfred Road, Birkenhead.

Liverpool.—Crosby Amateur Photographic Association.—*Dead*

***London and Provincial Photographic Association.**—*Meetings*, Food Reform Restaurant, Furnival Street, E.C, Thursdays, 8 p.m. *Sec.*, Ernest Human, "Birchdale," Woodlands Avenue, Wanstead, Essex.

London County and Westminster Bank Photographic Society.—*Pres.*, J. J. Cater. *Meetings*, Sports Club, Norbury, Monthly, October to April, 7 p.m. *Secs.*, H. G. Hart, London County and Westminster Bank, Clapham Junction, London, S.W., and L. J. Harris, 21, Lombard Street, London, E.C.

***London County Council Camera Club.**—*Pres.*, Arthur E. Henderson. *Meetings*, County Hall, Spring Gardens, S.W., First and Third Mondays, 5.45 p.m. *Sec.*, Wallace L. Jenkins, 9, Spring Gardens, Charing Cross, London, S.W.

Londonderry Camera Club.—*Pres.*, Sir R. Newman Chambers. *Meetings*, 12, Strand Road, First Wednesdays. *Sec.*, R. W. Saville, 61, Beechwood Avenue, Londonderry.

Longton and District Photographic Society.—*Pres.*, Dr. A. Parkes, J.P. *Meetings*, Sutherland Institute, First and Third Thursdays, September to April, 8 p.m. *Sec.*, Thomas Mottershead, 32, Stafford Street, Longton, Staffs.

Loughborough Photographic Society.—*Pres.*, W. W. Coltman, J.P. *Meetings*, Adult School, Alternate Fridays, 8 p.m. *Ex.*, March. *Sec.*, J. E. Underwood, 7, Middleton Road, Loughborough.

***Maidstone and Institute Camera Club.**—*Pres.*, F. J. Argles, *Meetings*, Church Institute, Second and Fourth Thursdays, 8.30 p.m. *Ex.*, September. *Sec.*, W. J. Corke, Bower Lodge, Maidstone.

***Malvern Camera Club.**—*Pres.*, Stanley Baldwin, M.P. *Meetings*, Priory Place, Church Street, First and Third Mondays during winter, 8.15 p.m. *Ex.*, May. *Sec.*, J. Bate Nickolls, F.C.S., The Exchange, Malvern.

***Manchester Amateur Photographic Society.**—*Pres.*, James Shaw. *Meetings*, 5, Carr Street, Tuesdays, 7.30 p.m. *Sec.*, George M. Morris, 9, Chandos Road, Chorlton-cum Hardy, Manchester.

Manchester Photographic Society. — *Pres.*, Julian T. Bee. *Meetings*, 135, Deansgate, Second Mondays, 7.30 p.m. *Sec.*, C. H. Coote, Holly Bank, Ashton-upon-Mersey, Manchester.

Manchester Camera Club.—*Sec.*, Charles Dawson, 34, Queen Street, Manchester.

Manchester—Simpson Memorial Camera Club.—*Pres.*, Dr. A. T. Lakin. *Meetings*, Simpson Memorial, First and Third Fridays, 8 p.m. *Sec.*, G. W. Dunn, Lightbowne Road, Moston, Manchester.

Manchester Y.M.C.A. Photographic Society.—*Pres.*, J. W. Price. *Meetings*, Y.M.C.A., Fourth Wednesdays, 8 p.m. *Sec.*, James Shaw, Y.M.C.A., 56, Cross Street, Manchester.

Margate Photographic and Scientific Society.—*Pres.*, A. Léon Adutt, J.P. *Meetings*, Shaftesbury House, Alternate Wednesdays from October 15, 8.15 p.m. *Sec.*, W. H. Izzard, 32, Madeira Road, Cliftonville, Margate.

***Marylebone Camera Club.**—*Pres.*, Frank O'B. Ellison, M.D. *Meetings*, 38, Upper George Street, Mondays, 8 p.m. *Sec.*, Harold G. Bailey, 10, Fulham Place, Paddington Green, London, W.

Midlothian Photographic Association.—*Pres.*, Robert Thomson. *Meetings*, 5, St. Andrew Square, Edinburgh, First and Third Thursdays, 8 p.m. *Sec.*, Chas. G. Thornton, 172, Dalry Road, Edinburgh.

Mill Camera Club.—*Pres.*, E. H. Joynson. *Meetings*, Joynson's Paper Mills, St. Mary Cray, Fridays, 8 p.m. *Sec.*, W. C. Swindon, River Cottage, St. Paul's Cray, Kent.

Morpeth Y.M.C.A. Camera Club.—*Pres.*, Alderman G. B. Bainbridge. *Meetings*, Y.M.C.A., Mondays, 8 p.m. *Sec.*, James Whittle, 30, Bridge Street, Morpeth.

Muirkirk Amateur Photographic Association.—*Particulars not received from Secretary.*

Nasmyth Photographic Society.—*Pres.*, Rev. Martin Anstey, M.A. *Meetings*, 3, Bridewell Place, E.C., First Fridays, 6 p.m. *Sec.*, F. W. Cannon, Eskdale, Waddon Road, Croydon.

Nature Photographic Society.—*Pres.*, Henry Irving. *Sec.*, Carl Edwards, Woodlesford, Leeds.

***Nelson Camera Club.**—*Pres.*, Alderman H. Eastwood. *Meetings*, Co-operative Buildings, Forest Street, Tuesdays, 7.30 p.m. *Sec.*, Fred. Hartley, 4, Pickup Street, Nelson, Lancs.

***Nelson Photographic Society.**—*Pres.*, A. E. Normington, M.B. *Meetings*, Victoria Hall, Scotland Road, Tuesdays, 7.30 p.m. *Sec.*, Henry H. Beetham, 98, Brunswick Street, Nelson, Lancashire.

Newcastle-upon-Tyne Camera Club.—*Pres.*, J. Walton Lee. *Meetings*, Central Exchange Hotel, Grey Street, First and Third Thursdays, 7.30 p.m *Sec.*, George C. Urwin, 22, Tenth Avenue, Heaton, Newcastle-on-Tyne.

Newcastle (Staffs.) Camera Club.—*Pres.*, R. Ridgway. *Meetings*, Studio, Friarswood Road, Fridays, 8 p.m. *Sec.*, A. C. Fisher, 18, Barracks Road, Newcastle, Staffs.

New Mills and District Camera Club.—*Pres.*, James P Chettle. *Meetings*, Union Road, New Mills, Second Thursdays, 8.30 p.m. *Sec.*, Alfred Whitehead. 20, Lea Street, New Mills, Derbyshire.

Night Photographers, Society of. —*Particulars not received from Secretary.*

Normanton Camera Club.—*Particulars not received from Secretary.*

***Northamptonshire Natural History Society (Photographic Section).**—*Pres.*, H. Manfield, M.P. *Meetings*, 63, Abington Street, Northampton, Irregular, 8 p.m. *Sec.*, J. Dickens, junr., 102, Abington Street, Northampton.

***North Middlesex Photographic Society.** — *Pres.*, Louis Dick. *Meetings*, Hanley Hall, Sparsholt Road, Crouch Hill, Wednesdays, 8 15 p.m. *Sec.*, Chas. A. Morgan, 23, Nelson Road, Stroud Green, London, N.

***North Wilts Field and Camera Club.**—*Pres.*, Rev. E. H. Goddard, M.A. *Meetings*, Technical School, Swindon, Third Tuesdays, 8 p.m. *Sec.*, Owen W. F. Thomas, 48, Westlecot Road, Swindon.

***Norwich and District Photographic Society.**—*Pres.*, A. E. Coe, *Meetings*, Castle Museum, Norwich, First and Third Mondays, 8 p.m. *Ex.*, October. *Sec.*, R. J. Delf, Peoria House, 16, Park Lane, Norwich.

***Nottingham Camera Club.**—*Pres.*, Thomas Wright. *Meetings*, Mechanics' Institution, Thursdays, 7.45 p.m. *Sec.*, H. Newson, Northcote House, Radcliffe-on-Trent.

Oldham Photographic Society.—*Pres.*, T. Taylor. *Meetings*, Trust Buildings, Manchester Street, Thursdays, 8 p.m. *Sec.*, Herbert Harrison, 23, Dane Street, Greenacres, Oldham.

Oldham Equitable Photographic Society.—*Pres.*, Wm. Miller. *Meetings*, Hope Street, Mondays, 7.30 p.m. *Sec.*, Chas. Ledger, 6, Airey Street, Oldham.

Oldham Lyceum Photographic Society.—*Pres.*, Arthur Andrew. *Meetings*, The Lyceum, First and Third Wednesdays, 8 p m. *Sec.*, S. Goodier, The Lyceum, Oldham.

Oldham Y.M.C.A. Photographic Club.—*Pres.*, Wm. Mann. *Meetings*, Y.M.C.A., Tuesdays, 8 p.m. *Sec.*, Percy B. Heaton, 171, Greengate Street, Oldham.

Oliver Goldsmith Photographic Society.—*Particulars not received from Secretary.*

Orchestral Photographic Society.—*Meetings*, 13, Archer Street, W., Alternate weeks. *Sec*, Herbert H. Hainton, 152, Rusthall Avenue, Chiswick, London, W.

***Oxford Camera Club.**—*Pres*, Sir W. J. Herschel, Bart. *Meetings*, University Museum, Alternate Mondays from October 6, 8 p.m. *Sec.*, Miss E. Gifford, Arlington House, Oxford.

Padiham Photographic Society.—*Pres.*, F. C. Long. *Meetings*, Technical School, Tuesdays, 7.30 p.m. *Sec.*, J. Hoole, 11, Albert Street, Padiham, Lancs.

Paisley Philosophical Institution (Photographic Section).—*Pres.*, Thomas Scott, Jr. *Meetings*, 28, Oakshaw Street, Fridays, 8 p m. *Ex.*, January. *Sec.*, Alec. F. Duncan, "Turnberry," Craw Road, Paisley.

Partick Camera Club.—*Pres.*, W. Fraser Smith. *Meetings*, 63A, Peel Street, Wednesdays, 8 p.m *Sec.*, John Roberts, 34, Dudley Drive, Hyndland, Glasgow.

Pathfinders Photographic Circle.—*Meetings*, 40, Gracechurch Street, E.C., Monthly. *Sec.*, Alfred Drew, 40, Gracechurch Street, London, E.C.

***Peterborough Photographic Society.**—*Pres.*, George Kirkwood, M.D. *Meetings*, Church Institute. *Sec.*, Percy G. Field, 79, Taverners Road, Peterborough.

Photographic Club.—*Meetings*, Red Cross Hotel, Paternoster Square, E.C., Wednesdays, 8 p.m. *Sec.*, A. Corbett, 2, Orchard Street, Portman Square, London, W.

***Photographic Society of Ireland.**—*Pres.*, W. N. Allen. *Meetings*, Sackville Hall, Dublin, Alternate Thursdays, 8 p.m., from October 2. *Ex.*, March. *Sec.*, John Rowland, 33, Park Avenue, Sandymount, Dublin.

Photomicrographic Society.—*Pres.*, Dr. G. H. Rodman *Meetings*, Food Reform Restaurant, Furnival Street, E.C., Second Wednesdays, from October to May, 8 p.m. *Sec.*, J. G. Bradbury, 1, Hogarth Hill, Finchley Road, Hendon, London, N.W.

***Plymouth Photographic Society.**—*Pres.*, J. I. Johnson. *Meetings*, The Athenæum, Alternate Fridays, 8 p.m. *Sec.*, E. A. Preston, The Athenæum, Plymouth.

***Polytechnic Photographic Society.**—*Pres.*, Howard Farmer. *Meetings*, 14, Langham Place, W., Mondays, 8 p.m. *Sec.*, W. Howard Musson, 309, Regent Street, London, W.

Portsmouth Camera Club.—*Pres.*, S. Dawe. *Meetings*, 52, Elm Grove, Southsea, Wednesdays, 8 p.m. *Ex.*, April. *Sec.*, James C. Thompson, 23, Elm Grove, Southsea.

Preston Camera Club.—*Pres.*, J. Toulmin. *Meetings*, Stanley Chambers, Lancaster Road, Mondays, 8 p.m. *Sec.*, William Cowperthwaite, 46, Hawkins Street, Preston.

***Preston Scientific Society (Photographic Section).**—*Pres.*, George Howarth. *Meetings*, 119A, Fishergate, Tuesdays, 8 p.m *Sec.*, W. Cragg, 41, Great Avenham Street, Preston.

Preston Pictorial Photographic Society.—*Pres.*, G. A. Booth, *Meetings*, 89, Fishergate, Fridays, 8 p.m. *Sec.*, F. Winning, 115, Warton Street, Lytham, Lancs.

Prudhoe and District Camera Club.—*Pres.*, E. W. Swan. *Meetings*, Co-Operative Society's Recreation Rooms, Alternate Fridays from October 10, 7.30 p.m. *Sec.*, Charles H Hall, 2, Beaumont Terrace, Prudhoe-on-Tyne.

Rawtenstall.—St. Mary's Church Institute Camera Club.—*Pres.*, Rev. W. H. Finney, M.A. *Meetings*, St. Mary's Schools, Wednesdays, 8 p.m. *Sec.*, Matthew Dawson, 55, Burnley Road, Rawtenstall, Lancs.

***Richmond Camera Club.**—*Pres.*, G. H. Rodman, M.D. *Meetings*, Castle Assembly Rooms, Thursdays, 8 p.m. *Secs.*, A. H. Etherington, L. and S. W. Bank, Richmond, Surrey, and C. G. Andrews, 2, Montague Road, Richmond, Surrey.

Rochdale Amateur Photographic Society.—*Pres.*, Isaac Renshaw. *Meetings*, 244A, Yorkshire Street, Wednesdays, 8 p.m. *Sec.*, A. E. Cooper, 72, Park Road, Rochdale.

***Rochester Naturalists' Photographic Club.**—*Pres.*, H. Wingent. *Meetings*, Mathematical School, First and Third Wednesdays, 7 30. *Ex.*, October. *Sec.*, A. W Ryder, Guildhall Pharmacy, Rochester.

Rodley, Farsley, Calverley and Bramley Photographic Society.—*Pres.*, William Bretherick. *Meetings*, Society's Rooms, Town Street, Rodley, Thursdays, 8 p.m. *Ex.*, January. *Sec.*, H. Crossley, West Royd, Rodley, near Leeds.

***Rotherham Photographic Society.**—*Pres.*, C. H. Moss. *Meetings*, Frederick Street, First and Third Tuesdays, September to April, 8 p.m *Ex.*, October. *Sec.*, Henry C. Hemingway, Tooker Road, Rotherham.

***Rugby Photographic Society.**—*Pres.*, A. K. Morgan. *Meetings*, Physics Lecture Room, Rugby School, Alternate Thursdays, 8 p.m., from October 9 to March *Sec.*, F.A. Haigh, 17, Cromwell Road, Rugby.

***St. Albans Camera Club.**—*Pres.*, T. Askwith. *Meetings*, 39, Alma Road, Alternate Tuesdays, 8.30 p.m. *Sec.*, F. T. Usher, Durham House, Cumberland Road, St. Albans.

St. Andrews Photographic Society.—*Pres.*, Professor P. R. Scott Lang. *Meetings*, 108, South Street, Fridays, Monthly from September 26, 8.15 p.m. *Sec.*, Edward J. Balfour, Largo Road, St. Andrews.

St. Clements Press Photographic Society.—*Pres.*, George Eaton Hart. *Meetings*, St. Clements Press, Kingsway, Tuesdays, October to March, 7 p.m., Saturdays, April to September. *Sec.*, Albert Maule, Newspaper Buildings, Portugal Street, London.

St. Helens Camera Club.—*Pres.*, A. W. Cook. *Meetings*, 32, Church Street, Tuesdays, 8 p.m. *Sec.*, J. Dennett, 31, King Edward Road, St. Helens, Lancs.

Sale Photographic Society.—*Pres.*, C. M. Dorman. *Meetings*, Reform Club, Wednesdays, 8 p.m. *Sec.*, H Peddar, Heath Villa, Brooklands, Cheshire.

***Salisbury Camera Club.**—*Meetings*, New Street, Irregular, 8.15 p.m. *Sec.*, Frank Watson, Ye Halle of John Halle, Salisbury.

Scarborough and District Photographic Society. — *Pres.*, J. E. Adnams. *Meetings*, Museum, Mondays, 8 p.m. *Secs.*, T. F. Brogden and Frank Foster, 92, North Marine Road, Scarborough.

Scottish Photographic Pictorial Circle.—*Pres.*, G. L. A. Blair. *Meetings*, 200, Buchanan Street, Glasgow, First Wednesdays, September to April, 8 p.m. *Sec.*, W. S. Crocket, "Borestone," Hamilton Drive, Shettleston, Glasgow.

Scunthorpe and District Camera Club.—*Pres.*, Dr. Behrendt. *Meetings*, Kimberley House, Clayfield Road, Alternate Tuesdays, from July 1, 7.30 p.m. *Sec.*, E. Palfreeman, 35, Clayfield Road, Scunthorpe, Lincs.

Shaw Church Institute Photographic and Art Society.—*Pres.*, J. R. Royds. *Meetings*, Church Institute, Second Fridays, 8.30 p.m. *Sec.*, John Maiden, 91, Rochdale Road, Shaw, near Oldham

Shaw-Crompton Camera Club.—*Pres.*, Henry W Taylor. *Meetings*, Club House, Collinge Street, Daily, 8 p.m. *Ex.*, December. *Sec.*, Urban Sellers, Fern Bank, Shaw, Lancs.

***Sheffield Photographic Society.** — *Pres.*, Henry S. Nutt, *Meetings*, Builders' Exchange, Cross Burgess Street, First and Third Tuesdays, 7.30 p.m. *Ex.*, March. *Sec.*, H. Merrill, Clevedon, Meadow Head, Sheffield.

***Sheffield and Hallamshire Photographic Society.**—*Pres.*, W. J. Williams. *Meetings*, Wentworth Cafe, Pinstone Street, Second and Fourth Wednesdays, 8 p.m. *Sec.*, H. H. Diver, 50, Hawkseley Avenue, Hilsbro, Sheffield.

Sheffield Friends' Photographic Society. — *Pres.*, J. W. Cusworth. *Meetings*, Friends' Schools, Hartshead, First and Third Wednesdays, 8 p.m. *Sec.*, John Varley, 238, Stanniforth Road, Attercliffe, Sheffield.

Shettleston Co-operative Camera Club.—*Pres.*, D. Hannington. *Meetings*, 47, Firpark Street, Mondays, 8.30 p.m. *Sec.*, W. B. Whyte, 61, Main Street, Shettleston, Glasgow.

Shotts Camera Club.—*Pres.*, John McKnight. *Meetings*, Strathfillan Place, Irregular, 7.30 p m. *Sec.*, Robert Fisher, 2, Green View, Shotts.

Shropshire Camera Club.—*Pres.*, Mrs. Walter Dugdale. *Meetings*, St. Mary's Parish Room, Shrewsbury. Irregular. *Sec*, Charles E. Franck, Shropshire Maltings, Shrewsbury.

***Sidcup Camera Club.**—*Pres.*, Harold Moore. *Meetings*, Public Hall, Hatherley Road, Second and Fourth Tuesdays, October to April, 8.15 p.m. *Ex.*, February. *Sec.*, Frank E. Clark, "Halewood," Station Road, Sidcup.

Skipton - Craven Naturalists and Scientific Association (Photographic Section).—*Pres.*, Arnold C. Powell, M.A. *Meetings*, Art Schools, Irregular, Fridays, 8 p.m. *Sec.*, Rennie Dodgson, 15, Belgrave Street, Skipton.

Slough Photographic Society.—*Pres.*, James Andrews. *Meetings*, Leopold Institute. *Sec.*, R Hallam, 58, Windsor Road, Slough.

Small Heath Photographic Society.—*Pres.*, Chas. F. Hayward. *Meetings*, Council Schools, Somerville Road, Alternate Thursdays from October 2, 8.30 p m. *Sec.*, H. Smith, 1, Miller Street, Birmingham.

Smethwick and District Photographic Society. *Particulars not received from Secretary.*

***Southampton Camera Club.**—*Pres*, W. Burrough Hill. *Meetings*, Philharmonic Hall, Mondays, October to April; other months, Alternate Mondays, 8 p.m *Ex*, March. *Sec.*, Charles M. Cooper, 203, Shirley Road, Southampton.

South Devon Teachers' Camera Club.—*Pres.*, A. W. Searley. *Meetings*, First Saturdays. *Sec.*, Charles Mole, Broadhempston, Totnes.

***Southend-on-Sea Photographic Society.**—*Pres.*, The Mayor. *Meetings*, Technical Schools, First and Last Tuesdays, 8.15 p.m. *Ex.*, January. *Sec.*, S. Wenman, 50, Baxter Avenue, Southend-on-Sea.

***South Essex Camera Club.**—*Pres.*, Thos. H. B. Scott *Meetings*, Carnegie Library, Manor Park, Second and Fourth Wednesdays, 8 p.m. *Sec.*, A. E. Farrants, 17, Kensington Avenue, Manor Park, London, E.

***South London Photographic Society.**—*Pres.*, Gideon Clark. *Meetings*, Central Library, Camberwell, Mondays, 8 p.m. *Ex.*, March. *Sec.*, J. Henry Perkins, 103, Bushey Hill Road, Camberwell, London, S.E.

Southport Photographic Society. — *Pres*, Dr. S. Tordoff. *Meetings*, 9, Corporation Street, Mondays, 8 p.m. *Sec.*, Captain G. C. Appleyard, 42, Part Street, Southport.

South Shields Photographic Society.—*Pres.*, Arthur Edmund Cowling *Meetings*, North of England Cafe, King Street, First and Third Tuesdays, 8 p.m. *Sec.*, Harrison Burgess, 15, Iolanthe Terrace, South Shields.

***South Suburban Photographic Society.**—*Pres.*, John Nixon, *Meetings*, Plough Hall, High Street, Lewisham, Wednesdays, 8 p.m. *Sec.*, Arthur E. Bache, "Holmwood," 43, Charlton Road, Blackheath, London, S.E.

Spen Valley Literary and Scientific Society (Photographic Section).—*Pres.*, Joseph Kaye. *Meetings*, The Museum, Liversedge, Second and Fourth Thursdays, winter; Second Thursdays, summer, 8 p.m. *Sec.*, Walter Cadman. 4, Granville Street, Heckmondwike.

Stafford Photographic Society.—*Pres.*, F Plant. *Meetings*, Weiss and Fowke's Studio, First and Third Mondays, 8.15 p.m. *Sec.*, A. Leonard Yapp, Augusta House, Tithe Barn Road, Stafford.

Stalybridge Photographic Society.—*Pres.*, W. H Rhodes. *Meetings*, Free Library, Tuesdays, 7.45 p.m. *Sec*, Fred. Whitaker, 195, Huddersfield Road, Stalybridge.

Stockport Photographic Society.—*Pres.*, S. B. Hooley. *Meetings*, Masonic Hall. *Sec.*, Allen Bann, 120, Chatham Street, Stockport.

Stone Photographic Society.—*Pres.*, W. Meakin. *Meetings*, Congregational Schools, Last Wednesdays, 8.15 p m. *Sec*, R. D. Hetherington, 15, Arthur Street, Stone, Staffs.

Stourbridge Institute Camera Club.—*Pres.*, Major J. R. T Mathews. *Meetings*, The Institute, Third Wednesdays, 8.30 p.m. *Sec.*, Chas. Ed. Evason, 154, High Street, Stourbridge.

***Stratford.—G.E.R. Mechanics' Institution (Photographic Section).**—*Pres.*, A. J. Hill. *Meetings*, G.E.R. Mechanics' Institution, Store Street, Wednesdays, October to May, 8 p.m. *Ex.*, March. *Sec.*, A. Woolford, 16, Grove Green Road, Leytonstone, London, N.E.

Streatham Photographic Society.—*Meetings*, At Members' Homes, Last Fridays, 8 p.m. *Sec.*, A. E. Delph, 40, Brexholm Road, West Norwood, London, S.E.

***Sunderland Photographic Association.** *Pres.*, Wm. Milburn. *Meetings*, Subscription Library, Alternate Thursdays, from October 16, 8 p m. *Sec.*, F. Ashton Milburn, 8, Thornhill Park, Sunderland.

Sunderland and District Camera Club.—*Pres.*, Octavius C. Wilmot. *Meetings*, Social Centre, The Royalty, Alternate Tuesdays, from October 14, 8 p m. *Sec.*, Charles H. Griffiths, 112, Sorley Street, Sunderland.

Sutton and District Photographic Society.—*Pres.*, Alfred Clough. *Meetings*, Sutton Mill Institute, First Fridays. 8 p.m. *Sec.*, J. Bentley, 7, Eastfield Place, Sutton-in-Craven, near Keighley

***Sutton Photographic Club.**—*Pres.*, C. Thwaites. *Meetings*, Y.M.C.A. Lecture Room, First and Third Thursdays, 8.15 p.m. *Sec.*, Vivian Jobling, Wolferton, Gordon Road, Carshalton, Surrey.

Swadlincote Photographic Society.—*Pres.*, G. S. Bragge. *Meetings*, Free Library, Alternate Thursdays, 8 p.m., from September 18. *Sec.*, T. W. Pittam, 90, Wilmot Road, Swadlincote.

***Swansea Camera Club.**—*Pres.*, C. A. Ceyler. *Meetings*, Temple Street, Weekly, 8 p.m *Sec.*, B. A. Willett, Essex Villa, King Edward's Road, Swansea.

Tamworth and District Photographic Society.—*Pres.*, G. L. Jennings. *Meetings*, 15, Market Street, First and Third Tuesdays, 8 p.m. *Sec.*, Miss D. R. Bird, 15, Cherry Street, Tamworth.

"Times" Camera Club.—*Pres.*, J. P. Bland. *Meetings*, *Times* Office, Printing House Square, E.C. *Sec.*, Alex. A. Barnes, *Times* Office, Printing House Square, London, E.C.

Todmorden Photographic Society.—*Pres*, H Barker. *Meetings*, Studio, Well Lane, Tuesdays, 8 p.m. *Sec.*, John W. Howorth, 5, Stones Terrace, Walsden, Todmorden.

***Tollington Park Old Tollingtonians Society (Photographic Section).**—*Pres.*, E. A. Butler, B A., B.Sc. *Meetings*, Tollington School, Muswell Hill, N. *Sec.*, F. C Bloodworth, 81, The Grove, Brockley, London, S.E.

Tooting-Bevill Camera Club.—*Dead.*

***Torbay Camera Society.**—*Pres.*, Colonel Macmullen. *Meetings*, Wellswood Hall, Torquay, First Wednesdays, 3.30 p.m. *Sec.*, Dr. Harley Gough, Glenallon, Torquay.

***Tunbridge Wells Amateur Photographic Association.**—*Meetings*, Dudley Institute, First Wednesdays and Third Thursdays, 8.15 p.m. *Sec.*, A. G. Batting, 16, Calverley Road, Tunbridge Wells.

Tynemouth (Borough of) Photographic Society.—*Pres.*, Archibald J. Snowball. *Meetings*, Presbyterian Hall, North Shields, Second and Fourth Thursdays, 8 p.m. *Sec.*, Joseph R. Johnston, 96, Linskill Terrace, North Shields.

***United Stereoscopic Society.**—*Pres.*, Dr. S. Walshe Owen. *Meetings*, 188, Holland Road, W., Monthly. *Sec.*, Geo. W. Stannard, 64, Oakfield Road, Anerley, London, S.E.

***Waddon Camera Club.**—*Pres.*, Charles Hussey, J.P. *Meetings*, Offices of Croydon Gas Company, Fridays, 7.30 p.m. *Sec.*, Urvine W. Pugh, 443, Brighton Road, Croydon.

Wakefield Photographic Society.—*Pres.*, E. Keightley. *Meetings*, Church Institute, Alternate Fridays, from October 3, 8 p.m. *Sec.*, F. J. Baines, Frampton Villa, Horbury, near Wakefield.

Walkley (Sheffield) Camera and Optical Lantern Society.—*Particulars not received from Secretary.*

Wallasey Amateur Photographic Society.—*Pres.*, S. K. Thackray. *Meetings*, 43, King Street, Egremont, Alternate Mondays from January 5, 8 p.m. *Sec.*, William Hayes, 110, Brighton Street, Seacombe, Cheshire.

Walsall Photographic Society.—*Pres.*, J. Venables, J.P. *Meetings*, Arcade Assembly Hall, Mondays, during winter, 8 p.m. *Sec.*, W. T. Comer, 4 and 6, Arcade, Walsall.

***Walthamstow and District Photographic Society.**—*Pres.*, T. R. Nunn. *Meetings*, The Hall, Vestry Road, Walthamstow, First and Third Mondays, 8 p.m. *Secs.*, S. Brigden and S. B. Goddard, 8, College Road, Walthamstow, Essex.

Warrington Photographic Society.—*Pres.*, A. Davis. *Meetings*, Old Academy, Tuesdays, 7.30 p.m. *Sec.*, J. W. Rowlands, 96, Ellesmere Road, Lower Walton, Warrington.

***Watford Camera Club and Photographic Society.**—*Pres.*, The Lady Ebury. *Meetings*, 100, High Street, Thursdays, 8.45 p.m. *Sec.*, W. Russell Thomas, 100, High Street, Watford.

Wellcome Photographic Club.—*Pres.*, H. S. Wellcome. *Meetings*, Wellcome Club, Dartford, Irregular. *Sec.*, Frank C. Starnes, Wellcome Club, Dartford, Kent.

West Bromwich Photographic Society.—*Dead.*

West Calder Camera Club.—*Pres.*, Robert Calder. *Meetings*, Thomson's Rooms, First Fridays, 7.30 p.m. *Sec.*, Lawrence Girdwood, 27, Hermand, West Calder.

***Westminster City School Camera Club.**—*Pres.*, Dr. Stevens. *Meetings*, The School, Mondays, 4 p.m. *Sec.*, Dr. Daniels, Westminster City School, Palace Street, London, S.W.

West Norwood and District Camera Club.—*Pres.*, W. Huntington, B.Sc. *Meetings*, L.C.C. Technical Institute, Thursdays, 8 p.m. *Ex.*, May. *Sec.*, A. G. Field, 28, Ilminster Gardens, London, S W.

West Stanley Photographic Society.—*Pres.*, A. Bolam. *Meetings*, Front Street, Wednesdays and Saturdays, 7.30 p.m. *Sec.*, R. Simpson, 9, Co-Operative Terrace, Stanley, Durham.

***West Surrey Photographic Society.** — *Pres.*, Dr. Pearson. *Meetings*, St. Michael's Parish Rooms, Alternate Wednesdays from September 17, 8.30 p.m. *Ex* November. *Sec.*, J. Isaac, 8, Boutflower Road, Battersea Rise, London, S.W.

Whitby Camera Club.—*Pres.*, William Brown *Meetings*, Waterloo Studio, Flowergate. *Sec.*, Woodhouse Parkinson, Ocean Road, West Cliff, Whitby.

Whitley District Camera Club.—*Particulars not received from Secretary*

Widnes Photographic Society. — *Pres.*, H. L. Tatters. *Meetings*, Bedford Chambers, Alternate Tuesdays from October 14, 7.45 p.m. *Sec.*, W S. Knowles, 87, Victoria Road, Widnes.

***Willesden Photographic Society.** — *Pres.*, F. C. Boyes. *Meetings*, Polytechnic, Priory Park Road, Kilburn, Mondays, October to April, 8 p.m. *Sec.*, C. A. Hoggett, "Ritson," 19, Flamsted Avenue, Wembley.

***Wimbledon and District Camera Club.**—*Pres.*, T. W. Derrington. *Meetings*, Technical Institute, Gladstone Road, Thursdays, October to April, 8 p.m. *Sec.*, Herbert C. Pridmore, 45, Stockwell Park Road, London, S.W.

Wishaw Photographic Association.—*Pres.*, Thos. Brown. *Meetings*, The Studio, Russell Street, Irregular, 8 p.m. *Sec.*, R. Telfer, Glasgow Road, Wishaw.

Wolverhampton Photographic Society.—*Pres.*, H. Holcroft. *Meetings*, Library, Waterloo Road, Irregular, 8 p.m *Secs.* A. Robinson and J. Parkinson, The Grammar School, Wolverhampton.

***Woodford Photographic Society.** *Pres.*, W. L. F. Wastell. *Meetings*, Wilfrid Lawson Hotel, First, Second and Third Wednesdays, October to May, 8.15 p.m. *Sec.*, F. G. Emler, Murton, Chelmsford Road, Woodford, Essex.

***Woolwich Photographic Society.**—*Pres.*, Charles Churchill. *Meetings*, Old Town Hall, William Street, First and Third Thursdays, 8 p m. *Sec.*, Albert Wood, 4, Herbert Road, Woolwich.

Worcestershire Camera Club. *Pres* , Rt. Hon. Earl Beauchamp, K.C.M.G. *Meetings*, 1A, High Street, Worcester, Mondays, 8 p.m. *Ex.*, March *Sec.*, G. H. Haycox, 25, St. Wulstan's Crescent, Worcester

Workington Photographic Society.—*Pres.*, W. L. Fletcher. *Meetings*, Liberal Club, Alternate Tuesdays from October 7, 8.15 p.m. *Sec.*, Frederic C. Livesey, Oakleigh, Workington.

***Worthing Camera Club.**—*Pres.*, W. Ayton Gostling, M.D. *Meetings*, 8-11, Liverpool Terrace, Tuesdays, 8.15 p.m. *Ex.*, March. *Sec.*, Major Edgar Hill, Rosetta, Grove Road, Broadwater, Worthing.

York.—St. Peter's School Photographic Society.—*Pres.*, S. M. Toyne. *Meetings*, St. Peter's School, Irregular, 6.30 p.m *Sec.*, H. L Chilman, St. Peter's School, York.

Yorkshire Philosophical Society (Photographic Section).—*Meetings*, The Museum, York, First Wednesdays, 8 p.m. *Secs.*, Cecil H. Cobb, 6, St. Peter's Grove, York; and T. W. Pottage, The Old Manor House, Fulford, York.

POSTAL CLUBS.

Amateur Postal Camera Club.—*Sec.*, W. L. G. Bennett, Kemerton, Torbay Park, Paignton, South Devon.

Anglo-Indian Postal Photographic Club.—*Secs.*, Miss M. H. Mann, Swaton Vicarage, Folkingham, Lincolnshire; and P. C. Sinha, 146, Baranashi Ghose's Street, Calcutta.

Architectural Postal Photographic Society.—*Sec.*, P. H. Wonham, 34, Sir Thomas White Road, Coventry.

Argosy Postal Photographic Club. *Sec* , Rev C F. Lowry Barnwell, Stramshall Vicarage, Uttoxeter.

British Postal Camera Club.—*Sec.*, Halksworth Wheeler, Church Street, Folkestone.

Camera & Co.—*Sec.*, H. Wild, "Berrycroft," Warwick Park Tunbridge Wells.

Camera Club for Amateurs.—*Sec.*, E. Fawssett, "Westfield," Heaton Road, Newcastle-on-Tyne.

Great Effort Postal Club (The).—*Sec.*, T. A. Rigden, Brenton, Finchley Garden Village, London, N.

Hand Camera Postal Club.—*Sec.*, George V. Myatt, "Sunningdale," West Worthing.

Lantern Slide Exchange Club.—*Sec.*, I. S. Hawker, Mutley House, Plymouth.

North West London Photofolio Club.—*Sec.*, F. G. Clift, 108, Willifield Way, Hendon, London, N.W.

Perseverance Postal Camera Club.—*Sec.*, E. H. Plumpton, Glen Lyn, Cobham, Surrey.

Postal Camera Club—*Sec.*, J. C. Warburg, 21, Pembridge Gardens, London, W.

Postal Photographic Club.—*Sec.*, Reginald A. R. Bennett, M.A., Walton Manor Lodge, Oxford.

Postal Pictorial Photography Club.—*Sec.*, Mrs. Mary C. Cottam, "Burleigh," St. Clements Road, Bournemouth

Postal Salon.—*Sec.*, R. Stockdale, 11, St. John's Terrace, Belle Vue Road, Leeds.

Quarterly Photographic Portfolio.—*Sec.*, T. H. Yeldham, 28, Dovercourt Road. East Dulwich, London, S.E.

Ripon Portfolio Club.—*Sec.*, Wilfred Wainwright, Fountains Hall, Ripon.

Secretaries' Postal Photographic Society.—*Dead.*

Somerset Postal Photographic Society.—For advanced workers *Sec.*, Bernard J. Mitchell, 3, Willow Vale, Frome, Somerset

Stereoscopic Society (The).—*Sec.*, B. Diveri, B A., Huntly, N.B.

Sun and Co. Postal Club.—*Sec.*, Martin J. Harding, Oakdene, Church Stretton.

Talbot Album Club.—*Sec.*, F. H. Langdon-Davies. Rutland Place, Boyne Hill, Maidenhead.

Three Legged Club.—*Sec.*, Miss A. K. Gubbins, Dunkathel, Glanmire, Co. Cork.

***United Stereoscopic Society.**—*Sec.*, George W. Stannard, 64, Oakfield Road, Anerley, London, S.E.

Zodiac Camera Club.—*Sec.*, Miss Agnes B. Warburg, 8, Porchester Terrace, London, W

Zoological Photographic Club.—*Sec.*, Jasper Atkinson, 33, St. Michael's Road, Headingley, Leeds

COLONIAL PHOTOGRAPHIC SOCIETIES.

Adelaide Camera Club.—*Pres.*, T. B. Ragless. *Meetings*, Adelaide Institute, Second Fridays, 7.45 p.m. *Sec.*, G. T. Harber, Foster Street, Parkside, Adelaide, South Australia.

Ashfield School of Arts Camera Club.—*Pres.*, Norman C. Deck. *Meetings*, School of Arts, First and Third Mondays, 8 p.m. *Ex.*, January. *Sec.*, E. P. Davidson, "Edgerton," Carlisle Street, Ashfield, New South Wales.

Auckland (N.Z.) Camera Club.—*Pres.*, G. O'Halloran. *Meetings*, Victoria Street, Second Mondays, 8 p.m. *Sec.*, F. J. Cullen, 31, Stanley Street, Auckland, New Zealand.

Auckland (N.Z.) Y.M.C.A. Camera Club.—*Pres.*, T. F. Hill. *Meetings*, Y. M. C. A., Second Wednesdays, 7.45 p.m. *Sec.*, Fredk. E. Cory, Y.M.C.A., Auckland, N.Z.

Australian School of Photographers.—*Pres.*, F. A. Campbell. *Meetings*, Working Men's College, Bowen Street, Melbourne, Last Thursdays. *Sec.*, A. Norton, Wybellenna, Tennyson Street, St. Kilda, Melbourne.

Balaklava Photographic Society.—*Pres.*, Rev. A. H. Reynolds, M.A. *Meetings*, Tuesdays, 7.30 p.m. *Sec.*, B. R. Banyer, Balaklava, South Australia.

Ballarat Camera Club.—*Pres.*, G. H. Ballhausen. *Meetings*, Y.M.C.A., Camp Street, Second Tuesdays, 8 p.m. *Sec.*, George H. Hutson, 226, Raglan Street, Ballarat, Victoria.

Ballarat Photographic Club.—*Pres.*, Prof. A. Mica Smith. *Meetings*, School of Mines, Wednesdays in each month. *Sec.*, Fred J. Mantell, Ballarat School of Mines, Ballarat, Victoria.

Bathurst Amateur Camera Club.—*Dead.*

Beecroft School of Arts Camera Club.—*Pres.*, Rev. A. M. Ogilvie. *Meetings*, School of Arts, Second and Fourth Saturdays, 7 45 p.m. *Ex.*, March. *Sec.*, Henry Chorley, Chepstowe, Cheltenham, Sydney, N.S.W.

Beechworth Camera Club.—*Pres.*, C. Hembrow. *Meetings*, Public Library, Beechworth, Victoria, Second Thursday in each month, 8 p m. *Sec.*, R. W. Lover.

Bendigo Amateur Photographic Association.—*Pres.*, J. G. Austen. *Meetings*, School of Mines, every Alternate Thursday, 8 p.m. *Ex.*, June *Sec.*, Jas. Miller, Bath Corner, Bendigo, Victoria.

Boulder Technical School Camera Club.—*Pres.*, J. F. Lynch. *Meetings*, Technical School, Mondays, 8 p.m. *Sec.*, F. A. Davis, Technical School, Boulder City, West Australia.

Burnett Camera Club.—*Pres.*, George Henry Finch. *Meetings*, School of Arts, Bundaberg. *Sec.*, Horace John Page, c/o S. F. Luke, Bundaberg, Queensland, Australia.

Cairns Amateur Photographic Society.—*Pres.*, R. G. Catt. *Meetings*, School of Arts, Second Thursdays, 8 p.m. *Sec.*, Arthur F. Hunt, Cairns, Queensland, Australia.

Cape Town Camera Club.—*Pres.*, Walter Johnson. *Meetings*, 10, Church Street, Fridays, 8 p.m. *Sec.*, W. Askew-Way, P.O. Box 802, Cape Town.

***Cape Town Photographic Society.**—*Pres.*, J. D. Cartwright, *Meetings*, Old Town House, Greenmarket Square, First Thursdays, 8 p.m. *Sec.*, H. W. Schonegevel, P.O. Box 1357, Cape Town.

Ceylon Amateur Photographic Society.—*Pres.*, J. H de Saram, C.M.G. *Ex.*, August. *Sec.*, Dr. Andreas Nell, The Victoria Memorial Eye Hospital, Colombo, Ceylon.

***Christchurch Photographic Society.**—*Pres.*, W. Robinson. *Meetings*, Y.M.C.A., First Mondays. *Sec.*, C. G. Ingall, 29, Gordon Avenue, Christchurch, New Zealand.

Clifton Hill Amateur Photographic Club.—*Pres.*, O. H. Coulson. *Meetings*, 70, Fenwick Street, First and Third Tuesdays, 8 p.m. *Sec.*, F. Dutton, 70, Fenwick Street, Clifton Hill, Melbourne, Australia.

Dunedin Photographic Society. — *Pres.*, J. Blair Mason. *Meetings*, Liverpool Street, Second Thursdays, 8 p.m. *Sec.*, Miss C. H. Mackenzie, c/o London Photographic Depot, Princes Street, Dunedin, N.Z.

East Malvern Amateur Photographic Club.—*Pres.*, Sydney Fox. *Meetings*, St. John's Parish Hall, Third Thursdays, 8 p.m. *Sec.*, Arthur H. Smith, Kilburn, 18, Wattletree Road, Malvern, Victoria, Australia.

Gawler Photographic Society.—*Pres.*, H. L. Marsh. *Meetings*, Alternate Tuesdays from January 4. *Sec.*, Arthur A. Johnson, King Street, Gawler, South Australia.

Gloucester (N.S.W.) Amateur Camera Club.—*Pres.*, H. F. Thompson. *Meetings*, H. F. Thompson's rooms, First and Third Fridays. *Sec.*, D H. Slade, Gloucester, New South Wales.

Gordon College Amateur Photographic Association.—*Pres.*, Thos. Lord. *Meetings*, Gordon Technical College, Geelong, Wednesdays, 8 p.m. *Sec.*, Horace L. S. Potter, 97, Weller Street, Geelong, Victoria, Australia.

Gulgong Amateur Photographic Society.—*Pres.*, Archdeacon Geer. *Meetings*, Club Room, every alternate Tuesday. *Sec.*, A. P. Lambert, Public School, Gulgong, New South Wales.

Gympie Amateur Photographic Society.—*Pres.*, Geo. B. Black. *Meetings*, Club Rooms, Mary Street, Fridays, occasionally from July 11, 7 p.m. *Ex.*, September. *Sec.*, Leonard Birt, care of Scottish Gympie Gold Mines, Limited, Gympie, Queensland, Australia

Hamilton Association Camera Club, Canada.—*Pres.*, J. M. Eastwood. *Meetings*, Hamilton Association Rooms, Public Library. *Sec.*, W. Henry Edwards, 168, Main Street, E., Hamilton, Ontario, Canada.

Hawke's Bay Camera Club.—*Pres.*, F. W. Williams. *Meetings*, Napier, N.Z. *Sec.*, T. Bruce Bear, c/o Napier Gas Co., Ltd., Napier, N.Z.

Ipswich (Queensland) Amateur Photographic Society.—*Pres.*, R. Henderson Johnston. *Meetings*, Hughes and Cameron's Rooms, Nicholas Street, Last Tuesdays, 7.30 p.m. *Ex.*, August. *Sec.*, Pearson W. Cameron, Nicholas Street, Ipswich, Queensland, Australia.

Johannesburg Photographic Art Circle.—*Sec.*, Harold Tayler-Smith, 71, Cuthbert's Buildings, Johannesburg.

Kapunda Photographic Club.—*Pres.*, J. E. A. Klose. *Meetings*, School of Mines, Alternate Tuesdays, 7.30 p.m. *Ex.*, September. *Sec.*, Thos. Warner, Chapel Street, Kapunda, South Australia.

King William's Town Photographic Society.—*Pres.*, Alfred Templar. *Meetings*, Border Club, Cambridge Road, 15th each month, 8 p.m. *Sec.*, Edward T. B. Gladwin, P.O. Box 33, King William's Town, Cape Province, South Africa.

Lismore Camera Club.—*Pres.*, C. St. H. Syer. *Meetings*, Studio, Molesworth Street, First Fridays. *Sec.*, Stanley I. Simmons, Lismore, New South Wales.

Manuwatu Camera Club, Palmerston North, N.Z.—*Pres.*, Jack Perrin. *Meetings*, Pratt's Hairdressing Saloon, First Mondays, 8 p.m. *Sec.*, Bert Pratt, The Square, Palmerston North, N.Z.

Maritzburg Camera Club.—*Pres.*, D. M. Eadie. *Meetings*, Hardy's Chambers, First Wednesday and Third Thursday. *Sec.*, A. R. Hopkins, 4, Hardy's Chambers, Printing Office Street, Pietermaritzburg, Natal.

Melbourne Working Men's College Photographic Club.—*Pres.*, F. A. Campbell. *Meetings*, College Lecture Hall, Alternate Tuesdays from May 12, 8 p.m. *Sec.*, Godfrey E. Roberts, 25, Churchill Grove, Glenferrie, Victoria.

Montreal Amateur Athletic Association Camera Club.—*Pres.*, C F. G Johnson. *Meetings*, 250, Peel Street. *Ex.*, April. *Sec.*, P. F. Calcutt, 250, Peel Street, Montreal, Canada.

Mosman Photographic Society.—*Pres.*, Adam F. Grant. *Meetings*. Military Road, Third Thursdays, 8 p.m. *Ex.*, September. *Sec.*, T. Vander Horst Homan, "Redcot," Sirius Cove, Mosman, Sydney, N.S.W.

Mount Gambier Photographic Club.—*Pres.*, P. C. Kook. *Meetings*, Chess Room, Institute, First and Third Fridays. *Sec.*, Edwin Kluge, Mount Gambier, South Australia.

Mount Morgan Camera Club.—*Pres.*, D. Baldwin. *Meetings*, School of Arts, First Saturdays, 7.30 p.m. *Sec.*, J. C. A. Terris, Jeannie Street, Mt. Morgan, Queensland.

Nelson Camera Club.—*Pres.*, C. Y. Fell. *Meetings*, Hardy Street, Second Tuesday in each month, 7.30 p.m. *Ex.*, October. *Sec.*, H. A. Hobbs, Hardy Street, Nelson, New Zealand.

Nelson College Camera Club, N.Z.—*Pres.*, H. L Fowler. *Sec.*, J. G. McKay, Nelson College, Nelson, New Zealand.

Newcastle (N.S.W.) Amateur Photographic Club.—*Pres.*, J. T. Williams *Meetings*, 43, Hunter Street, Last Thursdays *Sec.*, Walter J. Jamieson, William Street, Hamilton, Newcastle, N.S.W.

New South Wales Railway and Tramway Camera Club.—*Pres.*, Thomas Marsh. *Meetings*, Railway Institute, Sydney, First Tuesdays. *Sec.*, H. E. Perfect, Tram Depot, Rushcutters Bay, Sydney, New South Wales.

Northern Suburbs Camera Club, New South Wales.—*Pres.*, W. A. Gullick. *Meetings*, Pymble Club Hall. Third Monday in each month, 8 p.m. *Sec.*, N. McIntosh.

***Northern Tasmanian Camera Club.** – *Pres.*, R. L. Parker. *Meetings*, Club Rooms, Patterson Street, Launceston, Third Wednesdays. *Sec.*, L. Griffiths, 261, Charles Street, Launceston, Tasmania.

North Sydney Tramway Camera Club.—*Pres.*, F. Simmonds. *Meetings*, Tramway Depot, Tuesdays, 8 p.m. *Sec.*, Wilfred J. Tamsett, 77, Holt Avenue, Mosman, Sydney, N.S W.

Onehunga Camera Club.—*Pres.*, T. C. Turnbull. *Meetings*, Talma Studio, Third Mondays, 8 p.m. *Sec.*, Chas. A. Senior, The Printery, Onehunga, New Zealand.

Ottawa Photographic Art Club.—*Pres.*, Frank T. Shutt, M A. *Meetings*, Wilson's Art Studio, Sparks Street, Third Mondays, 8 p m. *Sec.*, William Ide, B.A., 447, Riverdale Avenue, Ottawa, Ontario.

Paeroa Amateur Camera Club.—*Pres.*, J L Hanna. *Meetings*, County Council Chambers, Second Tuesdays, 7 30 p.m. *Sec.*, John Hubbard, Paeroa, Auckland, New Zealand.

Perak Amateur Photographic Society.—*Pres.*, L. Wray, M.I.E E., F.Z S. *Meetings*, Poverty Flat, Museum Road, Taiping. *Sec.*, Geo. Bain, Taiping, Perak.

Peterborough (Ontario) Camera Club.—*Pres.*, Rev. .H. R. Thompson. *Meetings*, Corner Rubidge and Sherbrooke Streets. *Sec.*, N. A. Howard-Moore, Peterborough, Ontario, Canada.

Photographers' Association of Canada. *Pres.*, T. J. Letherdale *Meetings*, Toronto. *Sec.*, Fred. L. Roy, Peterboro', Ontario, Canada.

***Photographic Association of Victoria.**—*Pres.*, J. B. Grut. *Meetings*, 57, Swanston Street, Melbourne, Wednesdays, 8 p.m. *Sec.*, G. H. Pattison, 108, Queen Street, Melbourne, Australia.

Photographic Employees' Association of New South Wales.—*Pres.*, J. C. Cruden. *Meetings*, Queen's Hall, Pitt Street, Sydney, Third Monday in each month. *Sec.*, Walter Davies, 58, Cavendish Street, Petersham, Sydney, N.S.W.

***Photographic Society of India.**—*Pres.*, A. F. Norman *Meetings*, 40, Chowringhee, Calcutta, Second Tuesdays, 6.30 p.m. *Sec.*, A. K. Taylor, 40, Chowringhee, Calcutta.

***Photographic Society of New South Wales.**—*Pres.*, E. T. Fabert. *Meetings*, 47, Elizabeth Street, Sydney, Second and Fourth Tuesdays, 8 p m. *Sec.*, W. A. Rainbow, Box 829, G.P.O , Sydney, New South Wales.

Port Elizabeth Amateur Photographic Society.—*Pres.*, W. Arnott. *Meetings*, Athenæum Buildings, Alternate Wednesdays, from January 7, 8 p.m. *Sec.*, John F. Walsh, Roslyn Military Reserve, Port Elizabeth.

***Queensland Photographic Society.**-*Pres.*, Hon. W. H. Campbell, M.L.C. *Meetings*, Harper's Buildings, Elizabeth Street, Brisbane, Second Thursdays, 8 p.m. *Ex.*, September. *Sec.*, E Colclough, Lands Department, Executive Buildings, George Street, Brisbane, Australia.

Rockhampton Camera Club.—*Pres.*, W. S. A. Hunter. *Meetings*, Club Room, Alma Street, First Thursdays. *Sec.*, A. T. Nelson, c/o P. A. Nelson and Co., Alma Street, Rockhampton, Queensland.

St. John Camera Club, Canada.—*Meetings*, 65, William Street, St. John, New Brunswick. *Sec.*, J. Kaye Allison, P.O. Box 401, St. John, N.B., Canada.

Semaphore Photographic Society.—*Pres.*, J. Smith. *Meetings*, Esplanade, First Mondays, 7.45 p.m. *Sec.*, Charles W. Mart, Clark Street, Exeter, Semaphore, South Australia.

***South Australian Photographic Society.** — *Pres.*, Charles Radcliffe. *Meetings*, Institute, North Terrace, Adelaide, Second Thursdays, 8 p.m. *Sec.*, A. H. Kingsborough, 51, Rundle Street, Adelaide, South Australia.

Southern Tasmanian Camera Club. — *Meetings*, Petersen's Chambers, Macquarie Street, Hobart, Second Thursdays, 8 p.m. *Sec.*, J. H. V. Scarr, 359, Liverpool Street, Hobart, Tasmania.

***Toronto Camera Club.**—*Pres.*, Edwin Utley. *Meetings*, 2, Gould Street, Mondays, 8 p.m. *Ex.*, April. *Sec.*, Edward Y. Spurr, 2, Gould Street, Toronto, Canada.

Toronto Canoe Club Camera Club.—*Pres.*, H. H. Fullerton. *Meetings*, Club House, Second Thursdays, 8 30 p.m. *Sec.*, T. F. Livingstone, Toronto Canoe Club, Lake Street West, Toronto, Canada.

Toronto—Eatonia Camera Club.—*Pres.*, R. Y. Eaton. *Meetings*, 383, Brunswick Avenue, Tuesdays, 8 p.m. *Sec.*, Charles A. Coles, 20, Redpath Avenue, Toronto, Canada.

Toronto School of Science Camera Club.—*Pres.*, J E. Keppy. *Meetings*, Engineering Building, University of Toronto, Alternate Thursdays from October 15. *Ex.*, March. *Sec.*, C. R. McCollum, University of Toronto, Engineering Buildings, Toronto, Ontario, Canada.

Toronto Y.M.C.A. (Central) Camera Club.—*Pres.*, Charles Boles. *Meetings*, Y.M.C.A. Building, 415, Yonge Street, Second Tuesdays. *Sec.*, Harry Russell, 292, Yonge Street, Toronto.

Upper Canada College Camera Club.—*Meetings*, Upper Canada College, Toronto, Ontario. *Sec.*, O. M. Biggar, 249, Simcoe Street, Toronto, Ontario, Canada.

Victorian Ladies' Photographic Association.—*Pres.*, Miss M. A. Turner. *Meetings*, Working Men's College, Melbourne, Fourth Fridays. *Ex.*, November. *Sec.*, Mrs. T. G. Campbell, "Trewithen," Gordon Street, Melbourne, Victoria, Australia.

Wallaroo Camera Club.—*Pres.*, E. Martin. *Meetings*, Institute Buildings, Fridays, 7.30 p.m. *Sec.*, Walter H. Sedgley, Wallaroo, South Australia.

Wanganui Camera Club.—*Dead.*

***Wellington Camera Club.**—*Pres.*, A. de B. Brandon. *Meetings*, Exchange Buildings, Lambton Quay, Second Thursday in each month. *Sec.*, J. A. Heginbotham, Wellington, New Zealand.

Wellington Amateur Photographic Society.—*Pres.*, P. N. Denton. *Meetings*, Society's Rooms, 156, Lambton Quay, Alternate Fridays, 8 p.m. *Sec.*, George Greig, 203, Clyde Street, Island Bay, Wellington, New Zealand.

Wellington College Camera Club.—*Pres.*, A. C. Gifford, M.A. *Meetings*, Wellington College, Wellington, N.Z., Mondays during term. *Sec.*, A. H. Tattle, 18, Kent Terrace, Wellington, N.Z.

West Australian Photographic Society (Perth).—*Meetings*, Third Wednesday in each month. *Sec.*, A. R. L. Wright, Public Works Department, Perth, West Australia.

Winnipeg Camera Club.—*Pres.*, Rowe Lewis. *Meetings*, Enderton Building, Portage Avenue. *Sec.*, Jas. M. Iredale, Enderton Building, Portage Avenue, Winnipeg, Canada.

Tokyo — Nippon Photographic Society. — *Pres.*, Count N. Matsudaira. *Meetings*, Society's Hall. *Sec.*, Dr. K. Ando, 48, Waseda-Minamimachi, Ushigomoku, Tokyo, Japan.

Tokyo—Oriental Photographic Association.—*Meetings*, Atelier Miyauchi Hongo, Tokyo, Third Thursdays, 7 p.m. *Sec.*, Dr. K. Ando, 48, Waseda-Minamimachi, Ushigomoku, Tokyo, Japan.

* The Royal Photographic Society of Great Britain.

FOUNDED 1853.

Patrons.—His Majesty the King; Her Majesty Queen Alexandra.

President. –Chapman Jones, F.I.C., F.C.S.

Vice-Presidents.—W. B. Ferguson, K.C., M.A., F.R P.S.; J. B. B. Wellington.

Past-Presidents.—Sir Charles Eastlake, P.R.A., 1853 to 1855; Sir Frederick Pollock, Lord Chief Baron, 1855 to 1869; James Glaisher, F.R.S., 1869 to 1874 and 1875 to 1892; John Spiller, F.I.C., F.C S., 1874 to 1875; Sir W de W. Abney, K.C.B., 1892 to 1894, 1896, 1903, and 1904; Sir H. Trueman Wood, M.A., 1894 to 1896; the Right Hon. the Earl of Crawford, K.T., F.R.S., 1897 to 1900; Thomas R. Dallmeyer, F.R.A.S., 1900 to 1903; Major-General J. Waterhouse, I A., 1905 to 1907; J. C. S. Mummery, A.R I.B.A., Hon. Fellow, 1908-1910; the Right Hon. Lord Redesdale, G.C.V.O., K.C.B , etc.

Ordinary Members of Council:—

A. W. W. Bartlett.
F. C. Boyes.
D. Cameron-Swan.
H. Essenhigh Corke.
John H. Gear.
Chas. F. Inston
G. Lamley.
Furley Lewis.
Ernest Marriage.
F. Martin-Duncan.
His Grace the Duke of Newcastle.
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Chas. H. Oakden.
F. F. Renwick.
E. Sanger Shepherd.
C. Atkin Swan.
J. C. Warburg.
W. L. F. Wastell.

Treasurer.—A. Herbert Lisett.

Solicitor.—Francis Ince.

Auditors.—Messrs. Calder Marshall and Ibbotson, Chartered Accountants, 90, Cannon Street, E.C.

Meetings.—Held at 35, Russell Square, London, W.C. Weekly on Tuesday evenings, from October to June inclusive.

Secretary.—J. McIntosh, 35, Russell Square, London.

PHOTOGRAPHIC BODIES.

Under the following heading are arranged particulars of the chief photographic associations which cannot be appropriately included in the list of photographic societies.

THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

In Affiliation with the Chambre Syndicale de la Photographie et de ses Applications, of Paris.

The Association was founded in March, 1901, for the purpose of promoting the interests of professional photography, the assistance of its members in their business dealings, and rendering them advice and assistance when in legal or other difficulties.

All professional photographers in business for themselves, or as managers of firms or companies, are entitled to membership.

The subscription is 5s. per annum.

Members' meetings are held on the second Fridays in October and January. The meetings are held at the Royal Photographic Society, 35, Russell Square, W.C.

The Council generally meets the second Friday in each month, except July, August and September.

Members are entitled to transfer existing fire policies to a first-rate office at premiums 20 per cent. less than they are paying. Special arrangements have been made for insuring members' liability under the Workmen's Compensation Act.

The Association publishes a Handbook annually containing much valuable information concerning copyright and other laws which particularly affect photographers. The P. P. A. Circular, published at intervals, in addition to information concerning the work of the Association, also contains much useful information upon matters of interest and importance to professional photographers.

The Association will hold a Congress of Professional Photographers in 1914, in connection with the Photographic Arts and Crafts Exhibition at the Royal Horticultural Hall, Westminster, S.W., on similar lines to those most successfully held in 1910, 1911, 1912 and 1913. Admission to the Congress will be strictly confined to members of the Association.

OFFICERS, ETC.

PRESIDENT. Alfred Ellis.

PAST PRESIDENT.—Richard N. Speaight.

MEMBERS OF COUNCIL.

London.	*Country.*
Chase, H. Gordon.	Adams, Marcus (Reading).
Corbett, Alexander.	Brown, Frank (Leicester).
Dickinson, C. F.	Chapman, H. A. (Swansea).
Fry, S. Herbert	Comley, Hy. J. (Stroud).
Gray, W. E.	Cooper, H. Montague (Taunton).
Hana, George.	Illingworth, W. (Northampton).
Hardee, Oscar.	Kay, N. S. (Manchester).

London.	*Country.*
Kempsell, H. J.	Lankester, P. (Tunbridge Wells).
Parker, E. H.	Moffat, F. P. (Edinburgh).
Sims, Lang.	Robinson, R. W. (Redhill).
St. George, H. A.	Spink, H. C. (Brighton).
Vandyk, H.	Turner, T. C. (Hull).

SECRETARY.—Alexander Mackie, 89, Albany St., London, N.W.
TREASURER.—S. H. Fry, 5, Highbury Grove, London, N.
SOLICITOR.—P. E. Marshall, 35, Bedford Row, London, W.C.
AUDITORS.—A. Basil and C. St. John Vaughan.

PROFESSIONAL PHOTOGRAPHERS' SOCIETY OF NEW YORK.

PRESIDENT.—B. J. Falk.

SECRETARY.—Chas. Hallen, 311, Madison Avenue, New York.

PHOTOGRAPHIC CONVENTION OF THE UNITED KINGDOM.

The Photographic Convention was founded in 1886 for the advancement of Photography, and to afford opportunities for personal intercourse and exchange of ideas am... those interested in the Art, from all parts of the United Kingd...

The Twenty-Ninth Annual Meeting will be held at Perth, July 6-11, 1914. Retiring President—F. J Mortimer.

Meetings have been held at the following Centres:—1886, Derby; 1887, Glasgow; 1888, Birmingham; 1889, London; 1890, Chester; 1891, Bath; 1892, Edinburgh; 1893, Plymouth; 1894, Dublin; 1895, Shrewsbury; 1896, Leeds; 1897, Great Yarmouth; 1898, Glasgow (second visit); 1899, Gloucester; 1900, Newcastle-on-Tyne; 1901, Oxford; 1902, Cambridge; 1903, Perth; 1904, Derby (second visit); 1905, Dublin (second visit); 1906, Southampton; 1907, Hereford; 1908, Brussels; 1909, Canterbury; 1910, Scarborough; 1911, Exeter; 1912, Amsterdam; 1913, Bangor.

PAST PRESIDENTS.—J. Traill Taylor, Andrew Pringle, C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, William Crooke, Thomas Bedding, Sir William Herschel, Bart., Sir Robert S. Ball, Sir Robert Pullar, G. Herbert Strutt, Dr. John Joly, E. J. Humphery, Alfred Watkins, Sir Cecil Hertslet, H. Snowden Ward, Godfrey Bingley, J. B. B. Wellington.

The Council of the Convention is empowered to make grants in aid of photographic research.

MEMBERS OF COUNCIL.

G. W. Atkins (Elstree).
W. J. Ballard (Birmingham).
R. R. Beard (London).
A. Bedding (London).
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G. E. Brown (London).
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R. C. Davies (Liverpool).
A. H. De'Ath (Ashford).
F. Martin Duncan (London).
W. E. Dunmore (Paris).
Dr. A. R. F. Evershed (London).

MEMBERS OF COUNCIL (*cont.*).

Cecil Gothen (Hereford).
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H. M. Smith (Geneva).
W. H. Smith (Purley).
F. B. Tompkins (Chichester).
T. C. Turner (Hull).
G. W. Watson (London).
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A. Werner (Dublin).
A. W. Westrop (Bridgnorth).
C. Winter (London).
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S. H. Wratten (Croydon)

TRUSTEES.—George W. Atkins; Frederick Albert Bridge.

GENERAL SECRETARY AND TREASURER.—F. A. Bridge, "Downshire House," 128, Barry Road, East Dulwich, S.E.

PHOTOGRAPHIC SURVEY ASSOCIATIONS.

PHOTOGRAPHIC SURVEY OF EDINBURGH AND DISTRICT.

SECRETARY.—Andrew A. Gibb, Edinburgh Photographic Society, 18, York Place, Edinburgh.

PHOTOGRAPHIC SURVEY OF ESSEX.

Headquarters: Essex Museum of Natural History, Romford Road, Stratford.

PRESIDENT.—W. Whitaker, B.A., F.R S., F.G.S., &c.

SECRETARY.—V. Taylor, 49, Pulteney Road, South Woodford, Essex.

KENT COUNTY PHOTOGRAPHIC RECORD AND SURVEY.

PRESIDENT.—Sir David Salomons.

SECRETARY.—H. E. Turner, B.A., B.Sc., 14, Queen's Road, Tunbridge Wells.

PHOTOGRAPHIC SURVEY RECORD OF NORFOLK AND NORWICH.

PRESIDENT.—Russell J. Colman, D.L., J.P.

SECRETARY.—Geo. A. Stephen, Public Library, Norwich.

PHOTOGRAPHIC SURVEY AND RECORD OF SURREY.

PRESIDENT.—Hon. Henry Cubitt, Lord Lieutenant of Surrey.

SECRETARY.—Jarvis Kenrick, Bletchingly.

PHOTOGRAPHIC RECORD AND SURVEY OF SUSSEX.

PRESIDENT.—The Duke of Norfolk, E.M., K.G.

SECRETARY.—Frederick Harrison, M.A., 17, Compton Avenue, Brighton.

PHOTOGRAPHIC SURVEY OF WALES.

DIRECTOR.—W. Evans Hoyle, M.A., D.Sc.

Full particulars of scheme of subjects, etc., may be obtained from the Secretary of the local Committee, Gilbert D. Shepherd, Gresham Chambers, Kingsway, Cardiff.

PHOTOGRAPHIC SURVEY OF WARWICKSHIRE.

PRESIDENT—Sir J. Benjamin Stone, M.P.
SECRETARY.—Lewis Lloyd, Church Road, Moseley, Birmingham.
CURATOR (to whom all prints should be sent).—E. A. Biermann, 63, Ludgate Hill, Birmingham.
TREASURER. — S. J. Ford, King Edward's School, New Street, Birmingham.

PHOTOGRAPHIC SURVEY OF WORCESTERSHIRE.

SECRETARY.—Edgar M. Firth, Enderlie, Arboretum Road, Worcester.

THE FEDERATION OF PHOTOGRAPHIC RECORD SOCIETIES.

PRESIDENT.—Sir Benjamin Stone.
CHAIRMAN.—W. Whitaker, B.A., F.R.S., F.G.S.
TREASURER.—G. Scamell, F.R P.S.
SECRETARY.—W. W. Topley, 53, Coombe Road, Croydon.
The Federation consists of 3 Societies.

THE LONDON SALON OF PHOTOGRAPHY.

The object of the London Salon of Photography is to foster pictoria photography by exhibition of pictures in which individual artistic aim and feeling have found their expression by means of the camera. It is international in character. An Annual Open Exhibition is held at one of the most important Picture Galleries in London. The members of the London Salon of Photography include the following:—

Yarnall Abbott (Philadelphia).
J. H. Anderson (London).
E. R. Ashton (Tunbridge Wells).
Mrs. G A. Barton (Birmingham).
A. H. Blake (London).
Dr. E. G. Boon (Alassio).
R. M. Cocks (London).
R. L. Cocks (London).
Reginald Craigie (London).
D'Ora (Vienna).
R. Dührkoop (Hamburg).
Otto Ehrhardt (Dresden).
Rudolph Eickemeyer (New York).
B. F. Eilers (Amsterdam).
C. H. L. Emanuel (London).
Hugo Erfurth (Dresden).
Franz Grainer (Munich).
Victor Hoffmann (Buda Pesth).
T. Hofmeister (Hamburg).
O. Hofmeister (Hamburg).
E. T. Holding (London).
Charles Job (Hove).
Gertrude Käsebier (New York).
Mrs Minna Keene (Cape Town).
Alex. Keighley (Steeton).
H. Mortimer Lamb (Montreal).
F. Austin Lidbury (Niagara Falls).
Arthur Marshall (Nottingham).
J. McKissack (Glasgow).
Leonard Misonne (Gilly).
F. J. Mortimer (London).
Ward Muir (London).
Hector E. Murchison (London).
Bertram Park (London).
Josef Pecsi (Buda Pesth).
Nicola Perscheid (Berlin)
Paul Pichier (Vienna).
W H. Porterfield (Buffalo).
Guido Rey (Turin).
J. B. B Wellington (Elstree).
J. M. Whitehead (Alva).
Fritz Widder (Buda Pesth).
C. Wille (London).
Percy G. R. Wright (London).

Secretary of the Salon.—Bertram Park, 5a, Pall Mall East, London, S.W.

*THE SOCIETY OF COLOUR PHOTOGRAPHERS.

SECRETARY.—Arthur E. Morton, 97, Chesterfield Gardens, Harringay, London, N.

PORTFOLIO SECRETARY.—F. T. Hollyer, 9, Pembroke Square, W.

COMMITTEE.—George E. Brown, H. Essenhigh-Corke, A. W. Everest, A. J. Newton, Percy B. Tubbs, J. C. Warburg, and the Secretaries.

The Society has for its object "to further the progress of colour photography." It is open to all interested in colour photography, the annual subscription being 5s.

The avowed activities of the Society are:—

(*a*) The mutual interchange of ideas and experiences in colour photography by means of lectures, discussions, and a circulating portfolio of specimens and MSS., which shall include questions and replies.

(*b*) To obtain for members assistance by correspondence from more experienced workers through the medium of the honorary secretary.

(*c*) To hold an annual exhibition in London, open to members and non-members.

(*d*) To form a permanent collection of specimens, apparatus, etc.

(*e*) To arrange periodical instructional excursions to places of interest.

THE AFFILIATION OF PHOTOGRAPHIC SOCIETIES

WITH THE ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN

CHAIRMAN OF EXECUTIVE COMMITTEE.—A. Herbert Lisett.

SECRETARY.—J. McIntosh, 35, Russell Square, W.C.

BENEFITS AND PRIVILEGES.—Affiliated Societies are entitled to the following benefits and privileges:—

The loan of illustrated lectures on photographic and kindred topics, sets of lantern slides, lantern lectures, pictures for exhibition, etc., and interchange of lectures and lecturers between the affiliated societies.

Permits to photograph (see below).

One copy of each issue of the "Photographic Journal," in which are published the proceedings of the Affiliation Committee, the Transactions of the Royal Photographic Society of Great Britain, etc.

Admission to the Annual Exhibition of the Royal Photographic Society of Great Britain at reduced prices.

Members of affiliated societies joining the Royal Photographic Society of Great Britain receive exemption from the payment of entrance fees, provided they are and have been for at least two years members of an affiliated society.

Temporary use of the accommodation provided by the various societies to members of other societies away from their own districts, as a matter of grace, not as a right.

Annual competitions of pictorial photographs and lantern slides are arranged.

JUDGES OF COMPETITIONS.—A Board of Judges is prepared to meet three or four times per annum, at 35, Russell Square, to adjudicate upon competitions arranged by affiliated societies. The exhibits must be sent to the secretary, with full details of the competition, and it is to be understood that the judges will follow the rules adopted by the conference of judges (see below). The judges will not undertake to criticise any work submitted.

MANAGEMENT.—Every affiliated society has a voice in the management of the affiliation through the two delegates which each is entitled to appoint. The general body of delegates meet once a year, the business in the meantime being conducted by an executive committee. The two delegates appointed by each society need not necessarily be members of the society they represent. The entire income of the affiliation, with the exception of a charge made for clerical expenses, is placed by the Royal Photographic Society in the hands of the executive committee, which has to defray all expenses in connection with the work of the affiliation with the following exceptions: The Royal Photographic Society provides meeting-rooms, and office accommodation free of charge.

PERMITS TO PHOTOGRAPH. — Arrangements have been made whereby members of affiliated societies will be permitted to photograph in or at the following places without other formality than the production of the Red Book (which is non-transferable), if required by those in charge. This permission is subject to any special arrangements that may be made from time to time by the authorities, and it should be understood that these concessions are granted as a matter of grace and not as rights. Holders of the Red Book are expected to act accordingly :—Alexandra Palace and Park, Bristol Cathedral, Lichfield Cathedral, Romsey Abbey, Burnham Beeches, *Bushey Park, Coulsdon Common; Guildford, Abbot's (Trinity) Hospital; Guildford, Town Hall Interior "at convenient times"; Guildford, Holy Trinity Church, Guildford St. Mary's Church; *Green Park, *Greenwich Park, *Hampton Court Park, Gardens, and Green, Highgate Wood, *Hyde Park, *Kensington Gardens, *Kew Green, *Natural History Museum Gardens, *Parliament Square Gardens, *Primrose Hill, *Regent's Park, *Richmond Park and Green, *[1]St. James's Park, St. Paul's Churchyard (to 12 noon), *Victoria Tower Gardens.

The societies forming the affiliation are indicated by an * in the list of photographic societies preceding and following

CONFERENCE OF JUDGES.—The following rules and recommendations concerning photographic exhibitions, adopted by a meeting of

[1] In those places indicated by an asterisk only *hand cameras* may be used under this permit, and the photographing of persons or groups is not permitted.

judges, convened by the affiliation on April 11, 1900, and revised in June, 1903, have received the approval of the judges, whose names are published annually in the Photographic Red Book. The committee of the affiliation entertain the hope that every affiliated society will endeavour to conform to them as closely as possible. The rules are known to have proved decidedly beneficial in the past.

RULES.—1. The judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.

2. The judges shall have full power to withhold any award, and this shall be stated in the prospectus.

3. The judges shall have power to exclude all persons from the room while judging.

4. The judges' expenses shall be paid.

5. The judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.

6. No award shall take the form of a money prize.

7. Where there is a champion class, pictures which have previously taken awards in Open classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide, or other form; but in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

PRESIDENT.—Lord Provost Maitland.

SECRETARY.—John B. Maclachlan, Blairgowrie.

SECRETARY (Portfolio).—J. D. Ross, 10, Latch Road, Brechin

SECRETARY (Lantern Slide).—G. Cleland, 15, Braid Crescent, Edinburgh.

The Federation promotes annually The Scottish Photographic Salon. The 1914 Salon will be held in the Art Gallery, Aberdeen, February 14 to March 7.

SALON SECRETARY.—D. S. Rose, 259, Union Street, Aberdeen.

The Federation consists of 45 societies.

THE YORKSHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—J. W. Wright.

BUSINESS SECRETARY.—Ezra Clough, 10, Farcliffe Road, Bradford.

SECRETARY (Lantern Slide Section).— W. H. Womersley, Spring Hurst Road, Shipley.

SECRETARY (Print Portfolio Section). — Walter Trickett, Elm Farm, Bramley, near Leeds.

The Union consists of 28 societies.

THE LANCASHIRE AND CHESHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—H. H. Beetham.

SECRETARY.—W. Tansley, 22, Chapel Place, Liverpool.

SECRETARY (Travelling Exhibition Prints).—T. Lee Syms, 69, Castle Street, Tyldesley.

SECRETARY (Lantern Slide Section).—F. Winning, 115, Warton Street, Lytham.

SECRETARY (Print Portfolio Section).—R. Wright, 15, Roosevelt Drive, Aintree, Liverpool.

A year-book is published, with a list of societies, lecturers and demonstrators, judges for exhibitions, etc.

The Union consists of 47 societies.

MIDLAND PHOTOGRAPHIC FEDERATION.

SECRETARY.—Lewis Lloyd, Church Road, Moseley, Birmingham.
The Federation consists of 35 societies.

FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF NORTHUMBERLAND AND DURHAM.

PRESIDENT.—Wm. Milburn, F.R.I.B.A.

SECRETARY.—Robert Chalmers, 17, Fawcett Street, Sunderland.
The Federation consists of 14 societies.

EAST ANGLIAN PHOTOGRAPHIC FEDERATION.

PRESIDENT.—T. H. B. Scott.

SECRETARY AND TREASURER.—E. Peake, Rydal House, Earlham Road, Norwich.

SECRETARY (Print Portfolio Section).—Bertram Cox (Lincoln)
SECRETARY (Lantern Slide Section).—C. H. Wallis (Chelmsford).
The Federation consists of 18 societies.

FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF WALES AND MONMOUTHSHIRE

PRESIDENT.—E. H. Griffiths.

SECRETARY.—C. H. Carder, Grangetown Gas Works, Cardiff.
The Federation consists of 4 societies.

INTER-CLUB PHOTOGRAPHIC ALLIANCE.

PRESIDENT.—John Bonnard.

SECRETARY.—Arthur Clayton, 41, Revidge Road, Blackburn.
The Alliance consists of 17 societies.

THE AMERICAN FEDERATION OF PHOTOGRAPHIC SOCIETIES.

PRESIDENT.—John F. Jones, 723, Ash, Toledo, Ohio, U.S.A.

SECRETARY.—C. C. Taylor, 3223, Cambridge Avenue, Toledo, Ohio, U.S.A.

Founded for the advancement of pictorial photography, the encouragement of photographic record, etc. The American Salon is assembled by the Federation, which is responsible for its management. The salon is hung in the principal art museums and art centres of the United States, the tour lasting seven months, beginning with November 1.

THE PHOTO-SECESSION.

DIRECTOR.—Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.

Place of meeting, 291, Fifth Avenue, New York. The Secession holds continuous exhibitions in its galleries, not only of the most advanced international pictorial photography, but also of the most advanced international art expressions in other media.

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PREFACE.

One or two new features appear in the present "Almanac." Of these the glossary of photographic terms will, it is hoped, be of service to the many beginners in photography who study the "Almanac" for its description of apparatus, but come across many words in its pages which are not familiar to them. The list of the German, French, and Italian equivalents for the chief appliances and operations should also be a help to those referring to foreign photographic books and periodicals as well as to foreign readers of the "Almanac."

As an aid to the beginner, also, the series of reproductions of negatives, incorrectly exposed and developed, should be more effective than pages of printed description. Mr. C. H. Hewitt, who has prepared them, has usefully supplemented them by an article on the subject.

To the many readers of the "Almanac" in all parts of the world I would like to say that I am glad to deal with special photographic difficulties which they meet with, and am constantly doing so through "The British Journal of Photography." I do deal with the questions of, I suppose, many hundreds of "Almanac" readers in the course of a year, and largely as the outcome of these letters have arranged for a series of articles to appear week by week in the "B.J.", in which "Practicus" writes solely for the information of those of lesser experience. In an advertisement towards the end of the present volume Messrs. Greenwood publish a list of the articles of this series which have already appeared.

GEORGE E. BROWN,

Editor.

October 24, 1913.

LONDON: HENRY GREENWOOD & Co.,
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LENS FACTS FOR AMATEURS.

BY THE EDITOR.

By general consent, books on photographic optics are not popular reading among amateur users of cameras. Publishers of photographic manuals look askance at them, failing to see sales of large editions, and therefore I may be held to be taking a mean advantage of readers of the "Almanac" by making the lens the subject of this customary article. But the good reader who cares for none of these things can pass these pages by unread. Yet if he gets as far as this introductory paragraph I would encourage him further by the promise that he will find little of mathematical formulæ and calculations, but, it is hoped, a good deal directly bearing on the use, successful or otherwise, of his lens in everyday photography. Optics is certainly the most exact of the branches of knowledge which have to do with the taking of a photograph, but these notes deal not so much with optics as with the optical compromises and expedients which have to be adopted in practical photographic work. Let the reader take heart from this, and prepare himself to be convinced that without much show of u/v and $\frac{F}{f+1}$ it is possible, nay, easier, to put in clear and yet not inexact form the facts which are of chief importance in connection with photographic lenses.

What One Pays for in a Lens.

You realise the immense range of prices in photographic lenses from a few shillings to fifty pounds or more, and you naturally wonder whether the more costly lens is worth its price. You ask what is the difference between the results given by a lens which cost £5 or £10 by itself and those yielded by one on a 10s. camera. In many instances the photographs taken by the one look no better than those obtained with the other; or rather those with the cheaper are equal to those with the more costly. The photographs fail to show the great difference which should exist. I think we shall see that for many purposes the more expensive lens is worth

what it costs; we shall find that in other cases it is most certainly pure extravagance.

Qualities which Govern Price.

The lens makers' catalogues will tell you at a glance that prices run first in proportion to "focal length"; the greater the "focal length," the more the lens of a given type costs. Next, as a rule, the price increases with "aperture." The larger the "aperture" the higher the price of a lens of a given "focal length." We will come to the meaning of "focal length" and "aperture" directly; but, thirdly, the cost of the lens is greater in proportion to the "quality" of the definition which the maker claims for it, by which term "quality" we may understand extreme sharpness of definition from corner to corner of the plate. This is not all which is implied by "quality," but it is the chief part, and sufficient for our present reference. We will return to it in a moment.

Focal Length.

The maker usually marks its "focal length" on the lens, often calling it the "focus." It signifies the greater or less ability of the lens to do what it is the chief business of a lens to perform, viz., to bend rays of light to a greater or less extent. If you have ever thought about it, you have perhaps wondered how a lens forms a small picture of the scene before it. It is not such a difficult matter if you consider it. Imagine, for example, a subject such as a target a long way off. The light of the sun falls on it and is reflected. It is reflected in all directions, or scattered, because the surface of the target is dull (unpolished), as are the surfaces of almost everything which is photographed. The rays of light are cast to right and left, upwards, and downwards, and straight forward, so that we see the target wherever we may happen to be—so long as we are in front of it! These reflected rays fall upon the lens just as upon the eye, and if the lens were a flat piece of glass would pass through it practically unaltered in direction. But the lens, by reason of its curved surfaces, causes the rays of light emanating from any one point which fall all over it to be bent towards each other in passing through it and all to meet at a point some way on the other side. Thus the bull's eye of the target (which at the great distance is almost a point) reflects great numbers of rays, some few of which fall on the lens and are caused to meet on the other side, forming there a minute reproduction of the bull's eye. Similarly the rays from every point forming the rings of the target fall on the lens and meet again, to form altogether a much smaller picture or image of these parts.

And the same thing holds good for every point in the surrounding landscape: the lens gets a few of the innumerable rays reflected by each of them and, owing to its curves, bends their course so that each set is brought together as a point in the image. The point where these rays meet is, strictly speaking, the "focus" of the lens, and the whole surface of these points makes up the "focal plane." The distance from the lens to the focus is the "focal length," and is long or short according as the lens bends the rays towards each other little or much.

The Effect of Greater or Less Focal Length.

The chief effect of the focal length of a lens is that it determines the size of the picture—or, more correctly, the scale on which a distant subject is reproduced. With a long-focus lens on a given size of plate and from the same standpoint less of the subject is included, but larger compared with a lens of shorter focal length. In the case of distant objects, this increased size is in direct proportion to the focal length. If a lens of 5 ins. focal length reproduces a distant church tower as half an inch on the plate, one of 10 ins. will render it as 1 in. and one of 15 ins. as $1\frac{1}{2}$ ins. Therefore, at the same time, if the same size of plate be used with all three lenses, correspondingly less of the whole landscape will be included on the plate; the parts near the margins will be missing in the pictures obtained with the greater focal lengths, simply because the plate is not large enough to receive the whole of the image.

In these circumstances the lens is said to be giving a narrow "angle of view," but this expression applied to a lens has no really definite meaning apart from the size of the plate on which the image is formed. We may imagine a lens of long focus* fixed on a camera provided with a very large plate—say, a 20-inch lens and a 15 × 12 plate. If we consider only a central part of the plate the image formed on it represents a narrow angle of view. On the other hand, a 5-inch lens on a whole-plate is a wide angle of view, but over a central space of midget size (2 x 1 ins.) a narrow angle of view comparable with a 20-in. lens on a half-plate. To repeat—in speaking of narrow or wide angle lenses we must consider not the focal length, but the proportion the focal length bears to the long side or to the diagonal (it does not matter much which) of the plate.

In a later paragraph we shall consider the respective merits of narrow angle and wide angle in various descriptions of photographic work, but this cannot be done without considering also the aperture of the lens.

* That is of great focal length. For convenience we shall use the term "focus" as meaning "focal length," where no confusion is thereby introduced.

Before turning to this latter second factor in the price of a lens, let us bear in mind that the long-focus lens allows of our taking up a fairly distant standpoint and still getting a large-scale picture. Where such more distant standpoint is possible this is almost always an advantage, because the perspective, or drawing, of a photograph so obtained is better. Objects at different distances appear of more natural relative size in the photograph without the necessity which exists when short focus lenses are used of either enlarging or of taking special precautions to view the photograph at the right distance from the eye.

What is "Focussing"?

Lenses, as purchased, are always fitted with "stops," which nowadays are made in the convenient form of a number of leaves, which can be opened or closed so as to provide a series of circular apertures, the largest of which may be very nearly the full diameter of the glasses, whilst the smallest is one-sixth or one-eighth this diameter. We shall understand the use of these stops (or iris diaphragms, as they are called when of the sector pattern) if we consider again the state of things when the lens forms an image of a distant object. In the case of our target we saw that the rays reflected from each part of the subject start from a point and proceed to the lens. Where the distance is great they are practically parallel when they reach the lens, not according to Euclid's definition of parallel straight lines, viz., those which being produced ever so far both ways do not meet, but for all practical purposes parallel. When we speak of the focal length of a lens we mean "for parallel rays," *i.e.*, for those from a distance which is very great in comparison with the focal length of the lens, say, 100 to 500 times the focal length. But the nearer an object is to the lens the more the rays depart from this practical parallelism, and thus they are brought together again, not at the focus (for parallel rays), but a little further back.

Since almost every subject contains parts at greatly different distances from the camera, it is clear that the lens, as we have so far conceived it, cannot form a sharp image of all of them at once. If the plate is in the focal plane for distant objects, those which are nearer will be rendered unsharp, because the rays from them are brought to a focus a little further back, whilst if we set the plate further back, as required by a quite near object, then the rays from the distance cross (at the focus) and diverge again before they reach the plate, again producing unsharpness instead of a true point-for-point image. This adjustment of the plate to and fro from the lens, according to the distance of the object, is "focussing," and is necessary, to a greater or less extent according to the focal length of the

lens, to secure the best average sharpness of both near and distant parts of the subjects.

The Diaphragm Makes Near and Distant Sharp.

But, except in the case of a perfectly flat subject, such as a plan, focussing is clearly ineffective to make both near and distant sharp; it simply divides the unsharpness between the two or allows us to secure the definition of one at the expense of the other. To obtain both sharp in the same negative the diaphragm is used to restrict the bundle of rays passing through the lens. The rays from each point in the subject cover the whole surface of the lens, and, in the absence of a diaphragm, form a cone, the base of which is of the diameter of the lens, whilst the point or apex is the focus of the rays. If we insert a diaphragm we form a narrower cone of rays, and therefore the amount of spreading of each image-point due to the plate being in front or behind the true focus is reduced. Strictly speaking, a theoretically perfect lens brings objects at only one given distance into sharp focus, but by the use of a small enough diaphragm objects at distances from the extreme horizon to within a few feet of the camera are all rendered practically sharp. It is this rendering of near and distant sharp at the same time which is termed "depth of focus," and is conditioned chiefly by the diaphragm.

On Getting Sharp Focus.

The beginner often finds some difficulty in quickly obtaining a sharply focussed picture—sharp, that is, in the negative. In the first place it is necessary to have a fine focussing screen. Many of the ground-glass focussing screens supplied with cameras are too coarse in grain. Specially finely obscured screens may be bought, or a very fine screen made with very little trouble by a method worked out by Mr. C. Welborne Piper. An ordinary extra rapid dry plate is given a very short exposure to light, so as to fog it evenly all over. A second or so to a candle placed several yards away is sufficient. The plate is developed, fixed, and washed as usual. The even deposit of fog is then bleached out in a weak solution of iodine in potassium iodide. The plate is then placed in a weak bath of ammonia, which clears away the iodine stain and leaves an almost white deposit. After a short wash it is dried and ready for use as a focussing screen. One or two trials with different times of exposure and of development will most likely be necessary to secure a deposit of the right depth.

A further help to easy focussing is a magnifier or eye-piece, purchasable for a few shillings; one magnifying about three or

four diameters is sufficiently powerful for general work, and those sold about 2s. 6d. to 5s. are of about this power.

However sharply the image may be secured on the focussing screen, it is, of course, essential that the plate should come exactly into the position of the screen ; if it does not, the negative, when using the lens at a reasonably large aperture, will not be sharp. To test for this one plan is to wedge a focussing screen in the dark slide, matt side to the front, and to notice whether some printed matter, when focussed sharply with the full aperture of the lens on the focussing screen in the ordinary way, is also in perfectly sharp focus when replacing the focussing screen by the dark slide with the second screen in position and both shutters withdrawn. This method cannot be used with the solid pattern of plate-holder. For these make a slip of stiff card of long wedge shape. Lay a stiff metal or boxwood rule across the frame of the focussing screen that is across the side which faces the lens and slide the paper card as far as it will go between the two, making a mark on the card where the latter touches the rule. Repeat the operation on the dark slide with a plate in position and the shutter drawn. If the register is correct the two marks should be at the same place on the card.

At this point, therefore, we may say we have obtained a fairly clear idea of the meaning of the focal length of a lens, of focus and focal plane, and of the aperture of a lens.

Narrow or Wide Angle?

In one respect the focal length which we use solely decides the picture obtained on the plate from a given standpoint. This is in respect to size, and, therefore, for a given size of plate, in respect to the amount of the subject which it includes. Take size first. The longer the focal length the larger the picture obtained from a given standpoint. A 12-in. lens will give a picture of, say, a distant church twice the size of that given by a 6-in. lens, the camera being in the same position in each case. The difference is one of size only. If the smaller picture obtained with the 6-in. lens be enlarged to double the size it will be identical with that taken direct with the 12-in. lens. Thus, where it is wished to avoid the trouble of enlarging, the use of a long-focus lens is a positive advantage, but nowadays enlarging is such an easy matter that this advantage does not count for much, and the general tendency is to choose rather a short focus lens for general work and get the size which is required by enlarging the whole or part of the negative.

What is a Wide Angle Lens?

As we have already seen, long focus means a large picture and narrow angle of view ; short focus, *vice versâ.* Hence it is natural that you should think from this that there is no essential difference between a narrow, medium, and wide-angle

lens. Nor is there theoretically, from the standpoint we have just taken in pointing out how a lens is sometimes one and sometimes another. Yet there is an essential difference—namely, this: A lens of relatively long focus *can* be used perfectly to form a picture on a smaller plate, whereas a lens of relatively short focus requires to be of special construction to give a well-defined image over the whole of a relatively large plate. In other words, any lens may act as a narrow-angle lens, and most lenses as medium angle; it depends simply on the plate with which they are used. But a wide-angle lens must be of a definite type, possessing what is called "covering power" in a high degree, considering its short focal length. It may act as wide, medium, and narrow angle, but lenses not manufactured as wide angle can usually act only as medium and narrow angle.

So we have seen that the focal length of lens which is chosen for a given size of plate determines, first, the largeness or smallness of the picture, and consequently the lesser or greater amount of the subject included on the plate. If this were all it would be a much simpler matter to say which is the best focal length for any particular description of subject, but the matter involves also another quality in the pictures to which I have briefly alluded, viz., the sharpness in the picture of parts of the subject which are at different distances from the camera.

Depth of Focus.

The chief factor in securing this "depth of focus" (near and distant objects in focus in the one picture) is the diameter of the diaphragm in the lens; not the diameter of the diaphragm relatively to the focal length of the lens—that is, the so-called working aperture—but the absolute diameter of the stop which is used. If you want great depth of focus you must use a small diaphragm, which means using either a small lens or a small diaphragm in a large lens. If you want little depth of focus you must use a large diaphragm, and as you cannot have that in a small lens you must use a large lens that is one of long focus. This is why a small (*i.e.*, short focus) lens gives a sharp picture of both near distant objects, whilst a large (*i.e.*, long focus) lens does not give both in focus unless you use a small stop. With a short-focus lens you can get only the one thing—great depth; with a long focus you can get much or little, according as you stop down or not.

Subjects and Depth.

Now, apart from wanting pictures on a small or a large scale (for enlargement or for printing direct from the negative), the subjects which present themselves in photography differ as

regards the desirability of depth of focus. If we consider one or two examples we shall see that this is so. Take figure studies, such as children, peasants, singly or in groups of two or three. In such cases great depth of focus is a positive drawback. We get the more distant background of village street or country road as sharp as the subject proper, which is usually nearest to the camera. Here it is an advantage to have a large aperture, which means not a very short-focus lens. Incidentally, the longer focus is an advantage since we obtain a picture of a given size further away from the subject, and are, therefore, less observed. But in the case, say, of a flower garden, we want the greatest depth we can get—sharp detail in all parts of the flower beds. Hence, a small aperture for the sake of the depth it gives. As regards the choice of this aperture in the form of a short-focus lens with a large stop or a long-focus lens with a small stop, we are usually compelled to select the former for the reason that in such subjects a wide angle is necessary to include the desired amount of subject on the plate. Most interior views of rooms or churches represent exactly similar conditions.

Thus it will be obvious, from what we have just considered, that, as regards securing depth, a small lens is at an advantage over a large one; its smaller aperture gives greater depth in all circumstances, and if used on a plate of fair size it includes a fairly wide angle of view, though the picture is on a small scale. An $f/5$ or $f/6$ 4-in. lens on a quarter-plate represents this condition in practice. It takes in the subject over a fairly wide angle, and is therefore useful when one cannot get far away, whilst when we want to and can take a more distant standpoint we can enlarge part only of the negative. With a 6 or 7 inch lens of about $f/8$ aperture on a quarter-plate we get about the same amount of depth, but often meet with subjects where we wish to include more than this angle of view will take in. This very drawback has its compensating advantage, in that it forces us to take a more distant standpoint, and so avoid the less satisfactory drawing or perspective which results from placing the camera too near: with a short-focus lens there is the temptation to go closer to the subject in order to secure the larger picture instead of attaining this end by photographing from further off and enlarging to a greater degree. In these matters one cannot ignore the tendency of mortal man to do not what is best in the end, but what seems easiest at the moment. There is, too, another side to the question which up to this point we have left altogether out of the question. It is of some importance, for it is the effect of the size of the diaphragm in determining the time of exposure of the film or plate.

Relative Aperture="Speed" of Lens.

Depth of definition, as we have said, is determined chiefly by the *absolute* size of the diaphragm. Not so the amount or intensity of light which reaches the plate. This is determined by the size of the diaphragm *relatively to the focal length of the lens*. If the diameter of the diaphragm is only one-fourth the focal length, that is a very rapid lens—$f/4$. The expression denotes the number of times the diameter of the stop divides into the focal length. If the diameter divides six times into the focal length, that is an $f/6$ lens; if eight times, an $f/8$ lens; if sixteen times, $f/16$. These four degrees of relative aperture roughly represent the chief various degrees of "speed" in lenses. $F/4$ is the fastest in ordinary use, and is obtained in portrait lenses and in the largest aperture anastigmats—$f/6$ is a fair average relative aperture of anastigmats, $f/8$ is the relative or working aperture of the rapid rectilinear lens, whilst $f/16$ is about the speed of lenses sold as "wide angle" that is capable of covering a plate which is large in comparison with the focal length of the lens. The single or landscape lenses, which are little used at the present day, have a "speed" of about $f/11$. These are the numbers marked on lenses for various positions of the iris diaphragm, and the system of marking each stop with a number, which is the number of times the diameter of the aperture divides into the focal length, has the advantage of enabling the speed of any lens being compared with any other, however different the focal lengths may be. In the early days of photography this was not so. Photographers used stops of diameters $\frac{1}{2}$ in., $\frac{3}{4}$ in., or 1 in., and so on, and had to rely on experience in judging what speeds these sizes afforded with lenses of different focal lengths. Now $f/8$ is, to all intents and purposes, the same speed on every lens, and thus calculations of exposure are greatly simplified and the general use of exposure meters made possible.

Diaphragms and Exposure.

Usually a lens is marked with its largest diaphragm, which may be anything from $f/4$ to $f/16$, and also with a series of smaller stops which are almost always $f/11{\cdot}3$, $f/16$, $f/22{\cdot}6$, $f/32$, and, in the case of some lenses, the smallest diaphragms, $f/45{\cdot}2$ and $f/64$. These numbers are arbitrarily chosen so that each diaphragm requires double the exposure of the next larger. Thus, with $f/11{\cdot}3$, it is necessary to give twice the exposure required with $f/8$; with $f/16$, twice that with $f/11{\cdot}3$; with $f/22{\cdot}6$, twice that with $f/16$, and so on. In the case of diaphragms larger than $f/8$, the stop requiring half the exposure with $f/8$ is $f/5{\cdot}6$. With $f/4{\cdot}5$, an aperture at which

many lenses are now issued, the exposure is one-third that required with $f/8$. The rule for these differences is that the necessary exposure is proportional to the squares of the f numbers—that is, to the f number multiplied by itself. Thus, comparing $f/8$ with $f/11{\cdot}3$, the necessary exposures are in the proportion of 8×8 to $11{\cdot}3 \times 11{\cdot}3$, or 64 to 128; that is, 2 to 1, or, in other words, with $f/11{\cdot}3$, the time of exposure requires to be twice that with $f/8$.

This system having years ago been considered awkward in use, another scheme of working stops was devised, in which the numbers on the stops were in direct simple proportion to the exposures required. $F/4$ was taken as 1, and $f/5{\cdot}6$, therefore, marked 2; $f/8$, 4; $f/11{\cdot}3$, 8; and so on. The method was called the "Uniform System" (U.S.) by the committee of the Royal Photographic Society which devised it; but from the fact that it now survives only in some lenses made or mounted in America, it is sometimes assumed that its abbreviated designation signifies United States. Many American Kodak lenses are so marked.

Depth, F Numbers, and Focal Length.

It follows from the preceding paragraph that a lens, be it of long or short focus, may be of large "relative aperture." It is just as easy—indeed, easier—to make a 3-inch $f/4$ lens a. a 12-inch lens of the same f number. The speed depends on the diameter of the stop in proportion to the focal length, and, therefore, a long focus lens of great speed, such as $f/6$, must necessarily have its largest stop of large absolute diameter. But as we learnt from the paragraphs on depth of field, this quality is secured to a greater degree the smaller the absolute diameter of the stop. Hence depth of field, with the full speed of a long focus lens, is not possible, a fact which is of practical importance in two directions. In the first place we see how a short focus rapid lens such as the 3-inch $f/4{\cdot}5$, now largely used on pocket cameras, scores in combining both depth of field and shortness of exposure. Such a lens is called "large aperture," but this term is used in reference to its relative aperture. Actually, the diameter of its largest stop is small, and so the lens, though it covers a very small plate, yields a degree of depth equal to that of, say, a 12-inch lens at an aperture of about $f/16$. To get the same amount of depth with the longer focus lens we should need to give about sixteen times the exposure, and hence for many purposes the small camera can accomplish work which is altogether beyond the larger instrument. Much shorter exposures can be given, and results which are little inferior in

definition to those taken direct obtained by enlargement. This advantage is particularly felt in the case of moving subjects which it is required to photograph through a light-filter for the sake of correct tone-rendering of the colours and where, also, parts are quite close to the camera and others further away. A short-focus lens of about *f*/4·5 relative aperture is practically the only means of obtaining such results.

Large Aperture Less Useful in Long-Focus Lens.

Then, again, the disability of the rapid long focus lens as regards depth demonstrates the uselessness of going to the expense of a large aperture in a lens of 15 ins. or more focal length. Except for the special purposes of photographing flat subjects, such as plans or paintings, a greater relative aperture than *f*/8 is practically useless on account of the impossibility of obtaining near and distant objects in focus at the same time. It is absurd to pay twice or thrice the price for a 20-in. lens of, say, *f*/5 aperture, and then have to stop it down to *f*/8 or more likely to *f*/16. A lens of this kind in general work is always used with the camera on a tripod, and therefore great rapidity is not called for. A good rapid rectilinear of *f*/8 aperture is small in cost compared with an *f*/5 anastigmat of the same focal length, and at the stop with which either is perforce used serves equally well.

Fixed Focus.

The beginner in photography usually finds some difficulty in coming to a proper understanding of this term, and rather is apt to attribute virtues to the quality denoted by it which it does not possess. He learns that a "fixed focus" camera is one which does not call for a focussing adjustment. He therefore concludes that such a system must be better than that involving the necessity of focussing by setting the lens at the point on the scale indicating the distance which the object is judged to be. Not so, however. Fixed focus is really nothing more than the use of a small stop to obtain depth. Usually it is a stop of about ½-in. diameter or less, which secures a sufficient amount of depth for ordinary purposes.

Good, so far as depth is concerned, but how about speed of the lens? Since speed depends on the largeness of the diameter of the stop compared with the focal length of the lens, it is clear that a ½-in. stop provides less speed, the longer the focus. With a 5-in. lens, it yields *f*/10 (5 ÷ ½), not much of a speed for hand-camera photography. But with a 3-in. lens it provides *f*/6 (3 ÷ ½), which requires practically one-third the exposure of *f*/10. That is to say, fixed focus is a very good system for a short focus lens, and is most success-

fully used in the many 60 × 45 mm. vest-pocket cameras, fitted with 3-in. lenses of $f/6$ or even $f/4\cdot5$ aperture. But the longer the focus of the lens to which it is applied the worse it becomes as regards speed. Such cameras are very easy to use, and quite satisfactory in their results so long as the light is first-rate or the shutter does not give a time of exposure much less than 1-15 or 1-20 of a second. Outside of these limits, cameras of this kind cannot be expected to yield fully exposed negatives. Thus a quarter-plate fixed-focus camera requires a lens of about 5 ins. focal length, and with this you must use a fairly large stop and sacrifice depth or a smaller stop and sacrifice speed. With the lesser focal length of 3 ins. you can get both, and in the cinematograph camera, with its 2-in. focus large-aperture lens, you have the system working still better.

Quality of a Lens.

Now we come to consider the quality or goodness of lenses. The worst lens ever made is no worse than the best in its action of giving a larger or smaller picture, according as its focal length is great or small. But what sort of a picture? Is it sharply defined not only in the centre of the plate, but right into the corners? And is the power of the lens such that when we place it above the centre of the plate by using the rising front of the camera it still covers all the plate? It is in these respects that lenses differ very greatly, according chiefly, to their design, and also to the workmanship expended on them. A design capable of yielding a lens of the highest quality may fall short of its possible performance through inferior polishing of the glasses, mounting, or centering.

And also we must not forget that in judging the performance of a lens we must consider the relative aperture at which such and such results are produced. It is much more difficult to secure sharp definition over the whole of a plate at $f/4\cdot5$ than at $f/6$ or $f/8$. We pay for the combination of quality and speed in the $f/4\cdot5$ lens. If we are content to use a quite small stop, such as $f/32$, then the superiority of the $f/4\cdot5$ lens as compared with the $f/8$ lens very largely disappears. The chief defects which the optician has been at pains to avoid in producing a lens working with a large aperture are removed from an inferior lens simply by the use of a small stop.

A Fair Basis for Comparing Lenses for Quality.

But, comparing two lenses at the largest relative apertures at which they are made to work—*e.g.*, an $f/4\cdot5$ anastigmat and an $f/8$ rapid rectilinear, or R.R., each of the same focal length, it will be found that the former is superior to the

latter in the sharpness of the definition which it gives over the whole plate. In such a comparison it is necessary to take as the best subject some flat surface at right angles to the line running centrally through the lens. It would not do to take a subject consisting of objects at different distances from the camera, since the larger stop of the more rapid lens of itself would cause unsharpness of definition, not from any fault of the lens, but a result of the natural lesser "depth." But a flat subject shows the difference between the two lenses, which, in a word, is the ability of each to reproduce each tiny part in the subject as a separate smaller point in the image. If a subject be arranged in this way and be chosen with fine detail in it—*e.g.*, a well-printed sheet of newspaper—it will be found in photographing it with an *f*/4 anastigmat and *f*/8 R.R., both at the full aperture, that there is a decided difference. The anastigmat gives a negative which when examined with a magnifier shows the printed letters very sharply; the edges are more clean cut than with the R.R. This, in the centre of the negative. If a large plate be used and the marginal parts be similarly examined the difference is more pronounced. The distance from the centre at which definition begins to fall off perceptibly is much smaller with an R.R. than with most anastigmats. In other words, an anastigmat covers satisfactorily a much larger plate than an R.R. This better covering power over a wide angle is a very appreciable quality in the making of negatives, which are printed in the ordinary way by contact. The better definition over a narrower angle may not be very appreciable in the negatives themselves, but shows itself when enlargements come to be made from them.

Lenses With Defects Removed.

Other lenses than anastigmats possess this quality of rendering fine definition. The portrait lens has it, but over a very narrow field: a lens of about 10 or 12 ins. focus is required to give it over a 6×4 plate. It is less marked in single landscape lenses, but in the case of any type of lenses varies to a certain extent. It comes from the more or less complete removal from the lens of certain defects which prevent perfectly sharp definition being obtained. One of these defects is spherical aberration: the rays which fall in the central and on the marginal parts of the lens do not come to a focus in the same plane. Another is chromatic aberration, rays of different colours coming to a focus in slightly different planes. These two apply to rays which fall on the lens in any direction, straight or oblique. Astigmatism is a defect connected with oblique rays, and is one which makes it impossible for vertical and horizontal lines in the subject to be obtained sharply

defined in the same image; one or the other, but not both together. It is the complete removal of these defects without sacrificing speed in a lens which is the ideal of the optician. Many anastigmat lenses go far towards attaining it.

Flatness of Field.

A further very great difference between lenses is in the kind or curvature of surface on which they cast the picture of the subject. Of late years opticians have aimed at making this surface flat, an aim which is right enough, seeing that the focussing screen (and plate) is flat. The anastigmats are distinguished by this flatness of field, whilst many R.R.'s and single landscape lenses have fields which are of saucer-like curvature. Where the subject is flat, as plans, etc., to be copied, there is no question of the superiority of the flat field lens, but in other cases it by no means follows that in this respect the anastigmat is better than, or so good as, a concave-field lens There are plenty of subjects for which a concave field is more suitable than a flat field, and for this reason R.R. and single lenses are by no means to be despised. Often they prove themselves the most suitable lenses for given purposes, *e.g.*, in cases where the nearest part of the subject is in the centre, whilst the marginal parts are further away. A bust or three-quarter length portrait will often be a subject of this kind, as are also many articles, such as vases, flowers and fruit, trees, etc. In such cases it is to the advantage of the definition (at the largest aperture of the lens) that in order to form a sharp image on the focussing screen the rays from the nearer marginal parts of the subject meet not in the true field of the lens (for a flat subject), but a little way behind it.

Distortion.

This—a further defect of certain lenses—is the rendering of straight lines in the subject not straight in the photograph, as they should be, but curved or bowed. It is not a very serious defect, because it occurs to any appreciable extent only with single lenses, and with them only at the edges of the field. Moreover, as a large proportion of subjects do not contain straight lines, the distortion, even when a single lens is used for them, is not in the least noticeable, although the effect is, of course, present to exactly the same degree. The distortion differs according as the stop is placed before or behind the single lens. With the stop in its usual position in front, straight lines which fall towards the edge of the plate are bowed outwards like the outline of a barrel; if the stop is behind the lens they are bowed inwards—*i.e.*, assume the form of an old-fashioned pincushion.

Avoiding Distortion with Single Lenses.

When using a single lens of focal length about equal to (or 50 per cent. longer than) the long side of the plate which it is used to cover, say, 4¼ ins. to 6½ ins. for a quarter-plate, such distortion is quite marked in copying a plan or photographing an architectural subject where usually there are straight lines in all parts of the subject. If we could arrange matters so that straight lines on the subject came close to the centre of the picture there would be no objection to the single lens on this score, but it is not practicable to do this, except in one way—namely, to use a lens of long focus, say 12 ins. or more, on a quarter-plate. By so doing we utilise only the central part of the image given by the lens, and, so long as that is done, the distortion effect is avoided. But obviously it is necessary to refrain from using the rising front of the camera, since that simply means that we are employing the marginal part of the field of the lens where the distortion occurs. The lens requires to be kept practically opposite the centre of the plate. A single or landscape lens has certain advantages (see later), and, though it is now greatly out of fashion, it is well to remember this point in regard to its use.

"Separable" or "Convertible" Lenses.

These two terms describe a property of a lens which is of great practical importance. They signify that the component parts of the lens, when used alone, are themselves actual working lenses, usually of much longer focus than the complete lens. Thus the ordinary R.R. is composed of two single lenses, each of which is about double the focal length of the whole lens, and can be used for taking photographs, though with the largest stop which is fitted they do not give as good definition as the complete lens, but require to be used with a smaller stop. The anastigmat lenses differ among themselves in this matter of convertibility. Some are not convertible or separable at all; the separate glasses do not form any image whatever, or, if they do, not one which is of satisfactory definition. Others, such as the Zeiss Protar, are separable, and the separate halves yield satisfactory pictures with the largest stop which is fitted. Other anastigmats, on the other hand, require to be stopped down, as does the R.R., when the separate components are used.

Symmetrical and Unsymmetrical Lenses.

Separable lenses further differ among themselves as to their separate components being of equal or unequal focal length. If the former, the whole lens is said to be symmetrical; if the

latter, unsymmetrical. Thus the R.R., with each of its halves approximately double the focus of the whole lens, is symmetrical, but a fair number of anastigmats are made in which the focal length of one component is from 50 per cent. to 100 per cent. greater than that of the other (half as much again to twice). The practical advantage of this construction is that we get three different focal lengths in the one instrument. While usually the two components are not the equal of the whole lens in "quality," they are nevertheless of frequent use when a narrower angle but a larger picture is required.

Speed of Separate Components of Separable Lenses.

And here it should be mentioned that the separate components of a separable lens, even when they can be used with the largest stop fitted to the lens, are necessarily of much lower "speed" than the whole lens. That such is the case follows from the fact that their aperture relatively to their focal length is smaller. If a whole 12-inch lens has its largest aperture 2 ins. and is made up of components of 18 ins. and 24 ins. focus, then, neglecting a minor factor, the components, when used with this 2-in stop, will work at $f/9$ and $f/12$ respectively, and will require the exposure to be two and a-quarter and four times that necessary with the complete lens. And the same relation applies to each stop with which the lens is fitted. These different values of the stops, when the components are used separately, require to be kept in mind. Recently Messrs. Ross have introduced a method of providing all three sets of stop numbers so designed that when one or the other component is in use the correct f numbers are displayed.

Different Kinds of Lenses.

So far we have dealt with properties which mainly apply to lenses of every type. What is true of focal length or depth with one lens is true of any other, however different the construction. Now we must come to the chief classes of lenses, and consider some particular features of each.

Single Lens.—The "single," "landscape," or "view" lens is now made by scarcely any optician, but examples of it, such as those by Ross and Dallmeyer, are readily obtainable for a few shillings. One drawback, distortion, and its avoidance we have already dealt with. Another is the slow speed. Such single lenses are made with their largest aperture, $f/11$ to $f/16$, quite a sufficient aperture for stand-camera photography, but not adequate for regular work with a hand-camera. But against these drawbacks is the great merit of the view lens in yielding a bright image. No doubt many a photographic beginner who has used only the one lens with which his camera

is fitted has never realised the difference which exists between lenses in respect to this brilliance of image, using the term to denote the absence of veil or fog over the picture on the ground glass. But let him compare the effect of one of the ultra-modern types of anastigmat with an old view lens, particularly when the light faces the camera somewhat, and he will see that there is a crispness about the image of a single lens comparable with a perfect negative in contra-distinction to one which has been fogged. The difference arises from the simpler nature of the view lens, which is of two or more glasses, all cemented together so that there are only two surfaces which can reflect light. In many present-day anastigmats these reflecting surfaces number eight, as the result of the more complex construction by which their many pre-eminent properties are obtained. It is no disparagement of these latter to say that in ability to yield brilliant images, particularly when the light comes from a quarter more or less behind the subject, they are surpassed by the view lens. For landscape work with a stand-camera no better type of lens can be used; and for less than the cost of one anastigmat the worker can obtain a set of view lenses covering a wide range of focal lengths, whilst if he wishes to obtain a pleasing degree of softness of definition in place of sharp definition he can have the largest stop opened out to about *f*/8, and thus secure this quality in his negatives. The covering power is reduced, but if the lens be of long focus compared with the size of the plate this need not concern him.

Rapid Rectilinear.—For general medium-angle work of a size of half-plate and upwards, the R.R. is a most useful lens. Its speed of *f*/8 is amply sufficient for a very large proportion of instantaneous photography. The degree of definition given by it, though not equal to that of a good anastigmat, is satisfactory: any inferiority is not felt to be such a disadvantage in negatives of fair size as it is in those which are to be greatly enlarged, and, therefore, need to be of the sharpest character to start with. The separate components are usable as single lenses, of about twice the focal length if stopped down to *f*/22 or *f*/32 (about *f*/11 or *f*/16, as marked on the lens). In short, the R.R. at the present time is a most useful lens in focal lengths of 9 inches and over, and in these sizes is moderate in cost; where a shorter focus is wanted, with, usually, greater enlargement of the negative, choice may well fall on an anastigmat.

Anastigmats.—The anastigmat ranks above the R.R. in its greater aperture—*f*/6 to *f*/4·5 fairly represents the range—in its finer definition at the full aperture and in the wider angle which many cover, also at full aperture. Moreover, many

anastigmats when used with a stop of $f/16$ or thereabouts will cover a surprisingly large plate sharply to the edges, and thus are wide-angle lenses (see below). Anastigmats vary in construction, and it is largely a matter of personal preference whether one will select a non-convertible lens, such as the Tessar or the Cooke, or one of the convertible type, such as the Dagor or Protar; or, again, whether one of the latter class shall be symmetrical or unsymmetrical (*i.e.*, as regards the focal lengths of the components). Broadly, it will be found that extreme speed ($f/4{\cdot}5$) is secured in non-convertible lenses. Thus one usually has to choose one or the other, and where extremely short exposures (*e.g.*, 1-500th second) are not required, the balance of advantage, I think, is decidedly on the side of the $f/6$ or $f/6{\cdot}8$ anastigmat, with which type usually goes also the facility of the separate lenses and the absence of air spaces; the latter call for much greater care in shielding the lens from strong light than does the cemented type of construction.

Wide-Angle Lenses, are, as we have already seen, lenses which will cover plates large in proportion to their focal lengths. Formerly such lenses were of a special type, but the introduction of anastigmats has brought forward many lenses which form perfect wide-angle instruments when stopped down to a medium aperture. In addition to these latter, we now have anastigmatic wide-angles of special construction, the chief advantage of which is the large aperture—*e.g.*, $f/9$—at which they work; large, that is, for a wide-angle; the older non-anastigmatic W.A.'s of Ross and Dallmeyer had their largest aperture $f/16$ or $f/22$. In interior work it is a very positive advantage to be able to work at an aperture such as $f/9$, since focussing and the arrangement of the subject are both much easier, to say nothing of the shorter exposure which is required.

Portrait Lenses.—A portrait lens is a special type of objective of much more limited use than any of the other classes of lens we have just considered. It dates from the early days of photography, when every means of shortening the lengthy times of exposure was of prime importance. Its aperture is $f/4$—or, in some lenses, $f/3$—and at this great "speed" it yields very fine definition though over a small angle. Thus a portrait lens to cover a carte de visite ($3\frac{1}{2} \times 2\frac{1}{2}$ ins.) has a focal length of 8 or 9 ins; that for a cabinet portrait (6×4 ins.) 12 or 14 ins. It follows that the depth of focus with the full aperture of a portrait lens is very small. It is, of course, increased by a smaller stop, but with the loss of speed. The covering power, on the other hand, is not appreciably improved by stopping down. For its special purpose of portraiture, it is

excelled by no other form of lens, not even by the large-aperture anastigmats which are now largely used in place of it and, as regards range of covering power, flatness of field, etc., are greatly its superior. But the portrait lens is of service for very little else. It can be used for copying, it is not a bad lens for enlarging, although usually rather long in focus for the size plate it will cover, or it is useful at times as a long-focus large-aperture lens on a reflex camera for certain particular classes of work—such as figure studies or stage scenes by artificial lighting. Unless for some such special purpose, the portrait lens will probably be the last lens which an amateur worker will purchase.

Diffusion of Focus.

Before we come to the choice of a lens, in view of the predominance of any given class of work, we may say a few words on methods of obtaining soft or diffused definition—that is to say, unsharpness of a kind which is pleasing in appearance, and, if slight only, is a most desirable quality in portraits, whilst it is not to be despised in landscape work. We are speaking now of negatives which are to be printed direct—not enlarged—but, in regard to what is said of the production of diffusion, it should be remembered that the methods are applicable to the making of diffused enlargements from sharp negatives.

One of the simplest means of securing softness of definition is the single or landscape lens, with its aperture opened out to about *f*/8. Also the front combination of a portrait lens (of the type designed by Petzral) may be used as a single lens, and with a large aperture yields a pleasing degree of softness. If used with its flat side next the subject and with the stop in front, it covers a much larger plate; with the convex side next to the subject and the stop behind (that is, simply removing the back combination from the portrait lens) a better defined image is obtained at a larger aperture. In the case of the Dallmeyer portrait lens, the separation of the crown and flint glasses of the back combination introduces increasing degrees of softness, according to its amount. As now made, the lens is fitted with a most convenient means of making this adjustment. The "Cooke" portrait lens provides a similar facility. Lastly, there are the lenses in which the greater or less amounts of spherical and chromatic aberrations are purposely left uncorrected, in order to yield this diffused definition. The Dallmeyer-Bergheim was the first of these; others are the anachromatic lenses used by M. Puyo, and of late there are quite a series of soft-focus lenses, mostly of American origin, affording modified fuzziness of a kind and degree peculiar to each.

Is Great Covering Power Always an Advantage?

The beginner will very likely assume that in the matter of a lens covering a plate you cannot well have too much of a good thing. And in most circumstances this is a perfectly right belief. One wants a lens which will cover the plate perfectly to the corners, even when it (the lens) is raised level with a point, say, three-quarters or two-thirds up the plate instead of being opposite the centre. This means that the lens will cover a plate of the next larger size than the one it is intended for—that is, a 5 or 6 in. lens (intended for quarter plate) may well cover a half plate, an 8 or 9 in. lens, a whole plate, and so on. When so used to cover a larger plate a smaller stop, f/16 or f/22, will need to be used, but usually in such circumstances there is no inconvenience in the lower speed. But, on the other hand, there is a drawback to this quality in a lens. Obviously if it will cover a larger plate it exercises this power when it is used on a plate of the normal size, and in that case the outside portion of its field is cast upon the folds of the bellows or upon the sides, floor, and top of a box camera. Black as these are, they reflect an appreciable amount of light, which light is reflected and scattered upon the plate during the time of exposure. The result of this so-called "stray" light is a general slight veiling or fogging of the plate, varying in degree with the field of the lens and the character of the subject. Where possible it is best to avoid it, and this can be done in various ways. For example, in copying a drawing or sketch there is a distinct advantage in using a camera considerably larger than the plate requires, in order that the whole image cast by the lens shall fall flat on the surface directly facing the lens, and not partly on the bellows. Another plan is to place between the lens and the plate one or two diaphragms (black cards each with an aperture cut in them of the shape of the plate, but smaller). These receive on their front sides the image of the parts of the subject round the portion required on the plate, and any reflection is thus cast in a direction away from the plate. A third plan and the best is to provide one similar diaphragm in front of the lens; it is adjusted as regards size and distance from the lens so that only the rays actually forming the required image enter the camera. Such methods as these are easily applied in indoor work, such as copying, photographing flowers or other still-life subjects, or even in indoor portraiture; but they are somewhat troublesome in the outdoor use of a lens. In the latter branch of work a lens hood (some form of box, usually collapsible, screening the lens) is of positive advantage, even if its action is not to exclude the unrequired rays to just the correct degree.

The reader will understand from this why many expert photographers prefer, when doing copying and similar work, a

lens with a field which falls sharply off, e.g., a portrait lens and some types of anastigmat. When using a camera of size for which the lens is intended there is not the veiling by side reflection from the bellows. The same aim is shown by the practice of having the board or easel to which a drawing, etc., is pinned to be photographed of dead black surface; the marginal parts of the image are then very dark and will reduce this "stray-light" effect.

Lenses for Various Purposes.

We come now to what the reader will doubtless consider the essential part of the present paper—viz., the specification of the lenses which are best suited to particular purposes. Such selection as is here advised is simply the putting into more or less definite shape the considerations which we have studied in the preceding paragraphs. Perhaps we had best start with lenses for hand-cameras, since these form the chief part of those used by amateurs.

Hand-cameras of average size.—In the case of the three sizes of hand-cameras which may be said to fall in this class—viz., those for plates or films of 5 x 4, quarter-plate, or $3\frac{1}{2}$ x $2\frac{1}{2}$ inch size—the focal length which is suitable for average work is one somewhat less than the diagonal of the plate. For 5 x 4 a focal length of 6 inches; for quarter-plate of $5\frac{1}{4}$ inches; and for $3\frac{1}{2}$ by $2\frac{1}{2}$ of 4 inches. In each case this gives an angle of view of about 55°; a somewhat wide angle for pictorial effect, but, on the other hand, many subjects which are necessarily taken from a near standpoint can be satisfactorily included on the plate. With lenses of the focal lengths prescribed for the respective plates it will often be found an advantage to secure a narrower angle of view by taking a more distant standpoint and resorting to enlargement from the negative to a greater degree than would otherwise be done. This applies still more to the use of lenses of shorter focus—*e.g.*, 4 inches on a quarter-plate. This choice has the advantage of a possible wider angle of view; in fact, there is the danger that subjects will be taken at this wider angle as a rule by selecting a near standpoint, whereas the correct use of such a lens is to select a standpoint which, with most subjects, will render them quite small on the plate in the centre part of the image of a much greater amount of subject.

As regards relative aperture (f/No.), the shorter the focal length the larger it may be. For a $3\frac{1}{2}$ x $2\frac{1}{2}$ plate $f/4{\cdot}5$ is too large to be often of use; for quarter-plate $f/6$ is large enough; larger is more rarely of service, owing to the less depth possible with the wider diaphragm; and for 5 x 4 a lens of $f/6{\cdot}8$ or $f/8$ may be taken as of sufficiently large aperture for

average work. It is true that, particularly by press photographers, a lens of the large aperture of $f/4·5$ is adopted for 5 x 4, and even half-plate cameras, chiefly for securing negatives of single figures or small groups in the bad conditions of light under which press photography must often be done. Constant practice enables the press photographer to focus by scale to a nicety, or, rather, to be accurate in his judgment of the distance of the subject from the camera, but this sense is often difficultly acquired by those who are not using the camera daily, and the smaller aperture enables sharp pictures to be secured, even if the distance was not judged with such great accuracy.

Lastly, as regards the type of hand-camera, it requires to be borne in mind that those with ample rise of front require a lens which will cover a plate considerably larger than that for which the camera is made. Hand-cameras of the hand-stand pattern, such as Una, Sanderson, Vaido, and Correspondents, etc., afford a rise of front from one-third to one-half the height of the plate, which means that with the front fully raised the lens requires to cover a half-plate in the case of the quarter-plate camera. Anastigmats differ greatly in this reserve power of covering. Some will not cover an appreciably larger plate; others require to be stopped down to, say, $f/16$ or $f/22$, whilst others will do remarkably well at almost full aperture. Usually a lens made with its largest aperture, $f/6$ or $f/6·8$, is better in this respect than one constructed to work at $f/4·5$.

Vest-pocket cameras.—In the case of the very small cameras taking the 6 x 4½ cm. plate, the chief choice open to the user is in respect to the aperture of the lens, for the focal length (usually 3 inches) is conditioned by the construction of the camera. It is best to select a lens of $f/4·5$ aperture, for with such a short focus the actual diameter is still small and the depth of focus ample. Moreover, as fashions in lenses go at present, a camera of this kind with an $f/4·5$ lens is much more saleable than when fitted with an $f/5·6$ or $f/6$ lens. Since such small negatives are almost always enlarged to a very considerable degree—six to eight diameters—the lens requires to be of the best as regards quality—that is, to give the finest definition.

Reflex Cameras.—The choice of a lens for a camera of this type is determined by somewhat different considerations from those governing with other hand-cameras. First, as regards focal length, the lens has to be long enough in focus to require an extension which leaves room for the mirror to swing without fouling the back rim of the lens-mount. In many reflexes of quarter-plate size it must be at least 6 inches in focus; some

will take a $5\frac{1}{2}$ or 5 inch lens. Without knowing the peculiarity of a lens it is not possible to say from a knowledge of its focal length only, whether it will exactly fit a reflex with a given permissible space from plate to lens-mount. It depends on the "back focus" of the lens—that is, on the distance from the back rim of the lens to the plate when the lens is focussed on a distant object. Lenses, say, of 5 inches focus may differ by an inch or more in this respect, and therefore, when aiming at the shortest focus which can be used on a reflex, it is necessary to ascertain this back focus from the maker.

So long as a lens has a focal length which permits a clear way for the mirror, the practical difficulties of employing one of longer focus or larger aperture (or both) are counterbalanced in the reflex type of camera by the exactness with which focussing can be done. Many workers prefer for hand-cameras a lens of 7 to 12 inches focus on a quarter-plate, and this with a large aperture of $f/6$, or even $f/4{\cdot}5$. With the reflex, of course, there is no difficulty, then, of securing sharp focus on one spot, though the depth with anything over 6 inches focus and $f/4{\cdot}5$ aperture will be very small. The special advantage of the reflex is that it permits one to use both normal and long focus lenses without bothering about focussing scales, and, nevertheless, without risking unsharp negatives.

Landscape.—By landscape work we may describe the general run of amateur outdoor photography, with the exception of architectural exteriors and interiors. In such work done with a stand-camera the most suitable type of lens is one of fairly long focus (in relation to the plate) and medium aperture. Thus, for a half-plate a focal length of 9 or 10 inches is about the most suitable for general work, and the aperture need not be more than $f/8$. The depth with lenses of very wide-aperture is so small at this focal length that in nine cases out of ten a much smaller stop than the full aperture must be used. With such subjects great covering power is not required, and, therefore, the R.R., with its largest aperture of $f/8$, is a very suitable instrument. The single or landscape, so much used in the earlier days of photography, is also a most excellent type. Its aperture of $f/11$ or $f/16$ is ample for most purposes where shutter exposures are not required, and for brightness and "sparkle" in the negatives there is no better description of lens.

Architecture.—It is for architectural subjects, both interior and exterior, that the properties of the anastigmat lens are found to be more valuable than in almost any other branch of photography. In many of such subjects it is absolutely necessary to have a near standpoint and include a wide angle

of view, or to raise the lens on the camera front in order to secure a tall building. In both cases the anastigmat is the lens of lenses for ensuring satisfactory covering power. In interior work the advantage is two-fold, for the wide-angle anastigmat can be obtained to work at an aperture of about *f*/9, and thus permits of a much brighter picture on the focussing screen than the older wide-angle lenses of the R.R. type which work at *f*/16 or *f*/22. For a whole-plate, which is about the best size for architectural work, a 5-inch wide-angle anastigmat will yield crisp definition up to the corners of the plate. Such a lens is a necessary part of the architectural photographer's equipment, for many subjects cannot be completely included without it; but, whenever possible, it is best dispensed with, and a narrower angle employed on account of the foreshortening which such a near standpoint introduces into the drawing of the subject. But whether a short focus of 5 ins. or a normal one of 10 or 11 ins. (on a whole-plate) be employed, the anastigmat has the great advantage of wide covering power, which is of pre-eminent value in architectural work. Where a longer focus is used, 15 or 20 ins., its superiority is less marked, and many of the older R.R.'s or rapid symmetricals are equally useful.

Portraiture.—The low sensitiveness of the Daguerreotype plate, and, later, of the wet collodion plate, led to the development of the large-aperture "portrait" lens. Though the need of such high speed is much less than it was, owing to the great sensitiveness of gelatine plates, professional portrait photographers cannot make their exposures too short, and thus these lenses of aperture *f*/3 to *f*/4 continue to be largely used. For amateur work their great size when of decent focal length, 9 or 10 ins., is one disadvantage: they are too large and heavy for many of the light models of camera. Another drawback to them is the fact that practically they are suited for portraiture and nothing else, except copying and enlarging. For average portrait work it is as important to work with a long focus as at a large aperture, say 10 or 12 ins. on a half-plate; so that a lens of the "portrait" type inevitably represents weight and bulk on the camera front. As few amateurs go in for portraiture to the exclusion of other work, the best choice of a lens is an anastigmat of 9 or 10 ins. and about *f*/6 aperture. This is a compromise, and, like most compromises, not very satisfactory. Such a lens is really too sharp in its definition for portraits, which can do with a little diffusion of definition, as described in a previous paragraph; but short of one of the special soft focus lenses or a portrait lens proper, it is about the best selection which can be made.

Copying may be relegated to the last place, since it is a branch of work which an amateur will very occasionally undertake—not usually to an extent to justify the purchase of a special lens. But where such a purchase is to be made, one or two points may be borne in mind. Such copying is best done on slow "process" plates. If done in daylight, the exposures will still be nothing inconvenient in the way of length—a few seconds only. A copying lens to be used in these circumstances does not require to have a large aperture; if its largest aperture is *f*/16 it is enough, and plenty of R.R.'s and early pattern anastigmats are cheaply obtainable. The first of the anastigmats, the "Concentric," is an excellent lens for copying, though its largest aperture is *f*/16. But if copying by artificial light, the exposures on "process" plates become inconveniently long if the working relative aperture is not a fair size, and it must be remembered that when copying same size, *f*/6 as marked on the lens becomes *f*/12, and calls for four times the exposure. In short, for copying by artificial light an anastigmat of about *f*/6 aperture is a suitable type of lens. As regard focal length, it does not matter much whether it is great or small, except that the longer it is the greater the extension required in the copying camera, and the more even the illumination. When copying same size, this extension has to be twice the focal length of the lens; when enlarging two diameters, three times the focal length, and so on. Hence, a fairly short focus lens is best. When using a half-plate camera one of 6 ins. focus is convenient, as the usual extension of 22 ins. allows of copying to over two diameters—a degree of enlargement which is as much as is generally necessary.

The Care of Lenses.

In conclusion, a few words may be said on the proper care of lenses. They are particularly necessary nowadays because in the modern lenses with which opticians have provided photographers of late years glasses of a kind which are much more easily damaged are used. Exposure to light and air should be avoided as far as possible, since in time it may affect the perfect polish of the surfaces. When buying a lens it is a good plan to get at the same time a couple of caps with which to cover both front and back when the lens is not in use. Apart from safeguarding the lens from accidental scratches these coverings serve towards avoiding the deterioration in the surface. In cleaning a lens the best material is soft tissue paper. Ordinary tissue paper, as bought from the stationer's, is better than the customary pocket handkerchief, but the best is the very soft "papier josef." It is very necessary to clean the lens from dust before using it, for with the modern large aperture lenses, particularly

when exposed, a strong light falls upon the camera front, and a thin film of dust will cause a surprising amount of veil. In this connection it is equally important to see that the lens mount—both the inside of the tube and the outside of it where it projects inside the camera—is dead black. Bright metal parts, particularly in the camera, are responsible for many puzzling markings on negatives. Accidental shock, as by letting a lens fall, is, of course, liable to injure it. The chief danger is that the glasses will be put out of centre and the lens thus give imperfect definition. You can test for bad centreing by fixing a brightly illuminated object fairly level with the test focussing upon it, arranging the camera level with the test object. Now turn the lens in its mount. If the image on the screen moves in reference to pencil marks on the screen the lens is not properly centred, and should be sent to the makers for remounting.

EXPOSURE AND DEVELOPMENT

BY C. H. HEWITT, F.R.P.S.

Perhaps the most difficult things the beginner in photography has to do are to give proper exposure and proper development and to be able to decide, when the negative turns out unsatisfactory, whether it is exposure or development that is at fault. I might go a little further and say how necessary it is, and yet how difficult, to know whether the exposure has been too long or too short. As a teacher I have had some thousands of students working with me, and it is no uncommon thing to find a beginner attributing all his difficulties to not understanding development, whereas in reality most of his trouble arises from not systematising his exposure. Still, the resultant negative is the product of the two operations of exposure and development, and the negative produced by under-exposure and normal development is—in many cases and with certain subjects—sufficiently like the negative produced by normal exposure and under-development to give any tyro something in the nature of a puzzle.

SOME PRACTICAL DEFINITIONS.

Before proceeding further let me clear the ground a little by defining certain terms which will be used in this article. I always prefer, for example, to use the term "normal exposure" rather than to speak of "correct exposure," because any exposure which will give the worker the result he requires is the correct exposure in that particular instance. But what I mean by "normal" exposure is that exposure which, with the normal development following, will yield a negative having printable detail in the deepest shadows. Under-exposure is obviously something less than this, but usually it must be less than half if it is to be at all pronounced. Over-exposure, on the other hand, must be very considerably more than normal exposure; in fact, I prefer to say of anything up to six or eight times the normal exposure that it is full exposure, and only when the gradation in the high-lights begins to suffer do I speak of "over exposure." The latitude of almost all modern plates is so great that though the negative which has had six or eight times the normal exposure may look very different from one normally exposed, and will take much longer to print, the final result will usually be indistinguishable.

The reader may say: If this is so, why bother about exposure at all? Why not guess in every case, taking care always to guess long enough? The answer to this is that even when using an

exposure-meter or calculator, errors creep in, but that by guessing, all but the most expert, and they very often, would be making errors of enormous magnitude. Further, the fully exposed negative is, as already suggested, a slow printer, and if only for the purpose of saving fatigue in the later operations of print-making it is worth while getting the exposure as nearly normal as possible.

Over-development is obviously development for too long a time, but what is not so obvious to the beginner is that as the developer works more rapidly when warm than it does when cold, a development time of three minutes may be too short on a cold day and too long on a hot one. In the same way a stronger solution will give the required density more rapidly, so that accurate mixing of the solutions is of great importance if uniform results are to be obtained. Under-development being the converse, I need say nothing on it.

Separate Effects of (1) Exposure and Development, and (2) The Lens.

Contrast is the difference in light-stopping power of the most transparent and least transparent portions of the negative, or in a print the difference in tone between the high-lights and the shadows. Contrast is often confused with sharpness. Sharpness depends on the lens and focussing; contrast depends on the plate, exposure, and development. This confusion no doubt arises from the fact that the definition or sharpness of the print is emphasised by an increase of contrast. Suppose for a moment that we take a sheet of white cartridge paper, and in the centre of it we paste a sheet of dead black paper a foot square. We now focus this with absolute sharpness and expose two or three plates on it, developing the plates for, let us say, one minute, four minutes, and ten minutes. Now we print the negatives and we shall find that the outline of the black square is equally sharp in all three prints, but that the black will look blacker and the white surround whiter in the print from the longest developed negative. We have varied contrast, but not sharpness.

If we now expose another plate, still keeping the image sharply focussed, and then putting the image distinctly out of focus—the black square appearing on the ground glass with a blurred edge—expose yet another for the same time, develop these two together for the same length of time and then print, we shall have two prints with the same degree of contrast but with the definition varied. The contrast will be the same, but the one will be sharp and the other unsharp.

"Hard" or "Soft"—in Relation to the Printing Paper.

Softness is a term used to denote slight degrees of contrast. When applied to definition it is usually qualified by saying softness of definition. Harsh or hard negatives are those which possess too much contrast, and in the worst cases have little or no detail in the shadows. "Strong" and "vigorous" are terms applied to negatives which are fully developed; and "delicate," to negatives without much contrast, but these terms are entirely relative. A

negative might be too strong for printing in a gaslight paper, and too delicate for the carbon process. Hence the quality of the negative can only be defined in relation to some definite printing process. This being so, I may say the reproductions accompanying this article are made from prints on glossy bromide paper, but it must not be expected that a negative printed in half-tone will give exactly the degree of contrast the original possessed, though I hope it may be very near.

Variations in Effect by Exposure and Development.

Although my primary aim in preparing this article is to illustrate the faults of under- and over-exposure and under- and over-development, and various combination of these, it will be apparent that the illustrations will show how certain abnormal effects may be produced whenever they may be required for any special purpose. It is commonly said less exposure and more development will give an increase of contrast, while more exposure and shorter development will produce a softer result. As I have already pointed out, the latitude of modern plates is so great that it is difficult to make much difference in the final result by reasonable variations of exposure. Shortening or lengthening development is the practicable way of obtaining less or more strength in the negative. But if a good deal of contrast is required, a slight shortening of exposure tends to prevent the very full development from producing a somewhat too thick negative. On the other hand, if a very soft negative is aimed at by shortening the time of development, there may be some lack of shadow detail (particularly when using such a developer as pyro-soda with, say, 3 grains pyro to the ounce), the detail not appearing until the later stages of normal development. Hence a rather fuller exposure will ensure shadow detail appearing readily, and by the time the opacity of the high-lights is sufficient the shadow detail should be of printing strength. The best method of working when dealing with extreme cases is touched upon towards the end of this article.

A Meter for Correct Exposure.

It may now be well to consider briefly the principles of exposures, and while I recognise the advantages of the various exposure tables and calculators, I must point out that a method based on an actual measurement of the actinic strength of the light at the time of exposing has many advantages. There are several exposure-meters provided with painted tints and sensitive paper which darkens to match these tints, and all of them work satisfactorily, though I, personally, use the Watkins' Bee both in teaching and in my own work. The determination of exposure with any of these meters may be divided into three steps :—First, the measurement of the strength of the light, which is inversely proportional to the time the paper takes to match the painted tint; second, the adjusting of the scales for plate, stop, and, in some cases, subject; and third, the reading of the required exposure, which will be found opposite one of the other factors. Thus, taking the Bee meter as an instance,

the light is first measured, then the stop used is brought against the platė speed figure and, finally, the exposure is read opposite the figure indicating the time the paper took to darken on the light scale.

How Distance of Subject Regulates Time of Exposure.

With the Bee meter this reading gives the exposure for what I always call the average subject—that is, the usual street scene, a group on the tennis lawn, or a little afternoon tea-party in the garden. Such subjects are those most commonly photographed by the possessor of a small hand camera. When the subject varies the exposure must be varied also, and the most convenient method of deciding what variation is necessary is to consider the position of the nearest shadow or dark object. In producing the normal negative we must expose for the deepest shadow. The nearer we place the camera to the deepest shadow the longer will the exposure be. The further away we are from this deepest shadow the shorter will the exposure be. The following table shows what variations in exposure must be made by reason of distance, but I want to emphasise the point that the really important matter is the *distance of the nearest shadow or dark object*, and not the description of the subject. For example, the table says that an open beach or estuary scene requires an eighth part of the exposure which would be indicated by the meter for the average subject. But this is only on the supposition that this estuary scene has no dark object or shadow nearer than 300 ft. If the subject includes a dark boat lying on the sand or mud, and this boat is 20 ft. from the camera, then it is brought within the average subject classification. It is sometimes remarked that with such a very open view even including a near boat the exposure would be much shorter than for a garden group. True, but only because the light would be stronger on account of the open character of the view and the large quantity of reflected light from water and wet mud; and this is automatically allowed for by the rapidity of the darkening of the sensitive paper of the meter.

Table of Subjects.	Ratio of Exposure.
A. Open sea and sky, distant Alpine snows, light cloud effects, etc. Nearest shadow or dark object beyond $\frac{1}{4}$ mile	$\frac{1}{16}$
B. Open beach or estuary scene, with very light foreground, coloured cloud effects. Nearest shadow, etc., 300 ft. to $\frac{1}{4}$ mile	$\frac{1}{8}$
C. Open landscape, with light foreground. Nearest shadow, etc., 100 ft. to 300 ft.	$\frac{1}{4}$
D. Average landscape, cottages, trees, cattle, etc. Nearest shadow, etc., 30 ft. to 100 ft.	$\frac{1}{2}$
E. Average subject, street scenes, etc. Nearest shadow, etc., 10 ft. to 30 ft.	1
F. Near dark foreground, with heavy foliage. Single figure portraits out of doors. Nearest shadow within 10 ft.	2

I am afraid many of my readers may think this table rather formidable, but it is quite readily committed to memory once it is noted that working backwards from the average subject the exposures are halved each time, while in the distances the figures 1 and 3 change sides each time, 10 to 30, and then 30 to 100, and so on. So that once we have fixed in our minds that the nearest shadow is from 10 to 30 ft. away in the average subject we have the whole table at our fingers' ends.

About Shutter-Speeds.

One of the objections I have heard raised with regard to the use of the exposure meter is that, having made the measurement of the light and the calculations for stop, plate and subject, we have no method of accurately giving the ascertained exposure. There is something in this criticism of the shutter, but I cannot follow the argument further than this. It is as much as to say, "You have one inaccuracy and therefore you need not be accurate in any particular." Some workers possess a high degree of intuitive perception in the matter of estimating exposures, but one cannot assume the possession of this in workers under one's guidance. So, notwithstanding the weak point of shutter speeding, I would still advise the use of the meter. But the shutter should be tested, and in general if it have three or four speeds the actual speeds of which are known within an error of 25 per cent., one need not worry at all on this score. The speeds most generally useful might be a fifth, a tenth and a twenty-fifth of a second. Some workers might wish a fiftieth, and others one as slow as a half-second. Of course, such a series as a half, a quarter, an eighth, a sixteenth, and a thirtieth would do equally well, for, if the indicated exposure on the meter be a tenth of a second, a perfectly satisfactory negative would be obtained by giving an eighth. What I have said above with reference to the latitude of the plate would make this plain.

What to do with a Shutter with Awkward Real Speeds.

It is an easy matter to get a shutter tested. It may be sent to the National Physical Laboratory if desired, but one or two firms of lens and shutter manufacturers will test for a much smaller fee. Where there is a considerable gap between any two speeds, say a jump from an eighth to a fortieth of a second, it becomes necessary to work the shutter in conjunction with the stops. That is, if it is decided to use F-11 and it is found that the required exposure is a twentieth of a second—which is a speed not available—either F-8 and the fortieth must be used or F-16 and an eighth. Assuming that the worker is able to hold the camera steady for an exposure of an eighth of a second, the choice would depend on the character of the subject. If it included moving objects, the large aperture and more rapid exposure would be preferable, but if parts of the subject were distant and other parts somewhat near to the camera, the

greater depth obtained by the F-16 stop would be an advantage, and this stop might be used with the slower exposure. This, it may be pointed out, is one of the advantages of the range of speeds in which each exposure is half that of the preceding. It is then possible to get a range of equivalent exposures; thus—

F— 8	$\frac{1}{64}$ second	F—22	$\frac{1}{8}$ second
F—11	$\frac{1}{32}$,,	F—32	$\frac{1}{4}$,,
F—16	$\frac{1}{16}$,,		

the two factors being adjusted to suit the requirements of depth of focus or movement in the subject.

Lighting as Important as Exposure.

Although not strictly within the title of my article, I must call attention to the great importance of the lighting of the subject. There is no doubt that much disappointment is caused because certain subjects are photographed under totally unsuitable lighting conditions. Open views, for example, are always unsatisfactory unless photographed with reasonably strong side lighting, and for distant views this, together with a clear atmosphere, is almost essential. Many negatives, the poor quality of which is attributed to wrong exposure or faulty development, are primarily wrong because of bad lighting. It is, of course, true that by modifying exposure and development the poorness of the lighting may be counteracted to some extent, and when I come to consider the illustrations in detail this will be more apparent.

A Simple Developer.

Let me now outline the method of development, and while any developer will give satisfactory results, there is nothing to beat such a solution as rodinal—one to twenty-four—for simplicity and excellence of result. One great advantage of rodinal is that it is a one-solution developer, and there is therefore no temptation to tinker with it. The only modifications it is necessary to make for all ordinary work are dilution of the developer in certain circumstances and a variation of the duration of development. Thus a shorter time of development will produce a softer negative, and *vice versâ*. The only object of dilution of the developer is to prevent the too rapid acquisition of density in the high-lights and so to give the shadows a chance; for slow development with a weak solution produces more detail than rapid development with a strong one. Much difference must not be expected, and it is only in cases of known serious under-exposure that this method of working is advantageous, or at all events less likely to produce a harsh negative.

What is Meant by Under-Exposure.

In order to get a clear grasp of the way in which the duration of development affects the result we must understand that the terms *under-exposure* and *over-exposure* are only broadly descriptive. Thus in the case of an average subject, when we say the plate is under-exposed we usually mean that the shadow portions have had

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Fig. 1. Under-exposure: normal development.

Fig. 2. Normal exposure: normal development.

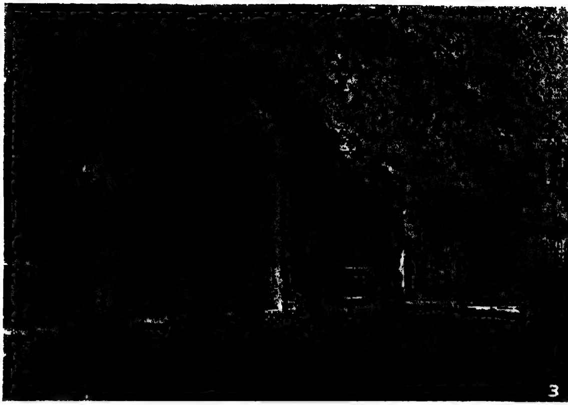

Fig. 3. Over-exposure: normal development.

Fig. 4. Normal exposure: over-development.

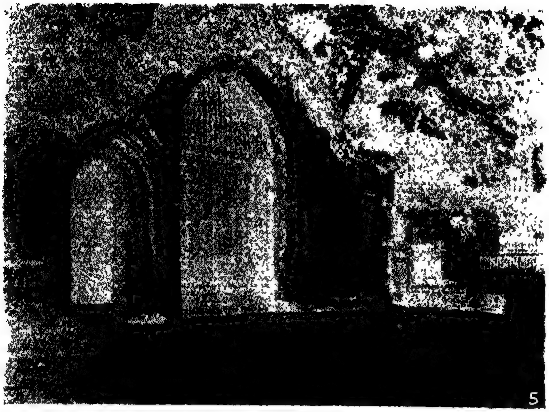

Fig. 5. Normal exposure: under-development.

Fig. 6. Under-exposure: over-development.

Fig. 7. Under-exposure: under-development.

Fig. 8. Over-exposure: under-development.

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Fig. 1A. Under-exposure normal development.

Fig. 2A. Normal exposure: normal development.

Fig. 3A. Over-exposure: normal development.

Fig. 4A. Normal exposure: over-development.

Fig. 5A. Normal exposure. under-development.

Fig. 6A. Under-exposure over-development.

Fig. 7A. Under-exposure: under-development.

Fig. 8A. Over-exposure: under-development.

insufficient light-action, the high-lights and lighter portions having usually had enough. Look, for example, at Fig. 1, the negative, and 1A, the print. This plate was under-exposed, but developed normally; that is, with normal strength of solution and for the normal time. The shadows are without printable detail, but the lightest portion, the block of masonry almost in the centre, is, taken by itself, not unsatisfactory. Now with such an exposure the temptation is to continue development in the hope of bringing up more detail in the shadows, and Figs. 6 and 6A show the effect of doing this. Instead of getting more printable detail—that is, *detail of use* in the negative—we have simply so increased the opacity of the better exposed portions that when these are printed the shadows are blacker and more detail-lacking still. Thus, 6 and 6A are similar to 1 and 1A, except that they show a great deal more contrast, and this contrast is due to prolongation of development. Negative 7 and print 7A illustrate the same exposure developed for too short a time, and here we see too little contrast, due to this under-development.

The Result of Over-Exposure.

Turning next to over-exposures we shall find less difference in the results. Fig. 3, the negative, and 3A, the print, show the normally developed over-exposed plate. That is, we get here the kind of result we should get were one section of a spool of film very much over-exposed and developed along with all the others in the length of spool for the same time, as it must be unless cut apart. The enormous latitude of a good plate to-day may be better appreciated when I say that this negative was over-exposed forty (40) times. There is a slight flattening of the print, more noticeable in the high-lights, but except for this loss of brightness little difference is to be seen as compared with Figs. 2 and 2A, the normally exposed and normally developed result. Of course, the negative is thick and consequently slow printing, but with such negatives, when the development has been full, the print is often surprisingly good as compared with the appearance of the negative. Indeed, it is by under-development that most over-exposed plates are spoiled, and if we look at Figs. 8 and 8A, where we have the same degree of over-exposure developed for a short time, we shall see that the flatness and muddiness is much worse. This difficulty arises from the fact that the fully- and over-exposed plates or films come up rapidly, and very soon are completely greyed over. The tendency of the beginner is to fear that the image is "fading away." So it is as an image on the *surface* of the plate, but it is actually increasing in strength further down in the thickness of the gelatine. Some workers prefer to remove the over-exposed plate from the developer quite early and to intensify it later on, but my own experience is that in general the full time of development will yield a negative of good contrast, and if it be somewhat thick it may be reduced in the hypo and ferricyanide reducer. I am assuming that such an over-exposure as forty times will very rarely occur, the more usual degrees of over-exposure being three or four up to perhaps eight times.

Normal Exposure—but Over-Development.

The under-development of normal exposures produces flat results which closely resemble over-exposures normally developed. Such a result is to be seen in Figs. 5 and 5A. The print has a slightly greater degree of contrast than that possessed by 8A, but its general effect is similar, and may approximate still more closely in the half-tone reproductions. It is this sort of thing which makes diagnosis so difficult for the inexperienced. The print is often very little use, and the negatives must be compared in order to get a clear indication. The over-exposed and normally developed plate, Fig. 3, is veiled and somewhat muddy, while the normally exposed and under-developed plate, Fig. 5, is thin and clear. This difficulty of diagnosis is often increased by the presence of fog, and if Fig. 5 were fogged in the dark room during development it would—as a negative—very closely resemble Fig. 3. It is in such cases that one must pay particular attention to the condition of the rebate edges of the negative. Where these are dirty, fog may be suspected. If they are clean, especially at the extreme edge, where the over-exposure effect has not been able to spread in the film, then over-exposure is the probable trouble.

Following up the point that longer development gives increased contrast, let us look at Figs. 4 and 4A, where we have a normally exposed plate developed so excessively that all the high-lights and half-tones have become opaque and only the shadow portions are printable. Print 4A was printed until the deepest shadows were black enough, and the harsh effect produced by the large areas of white paper needs no pointing out. Such a negative could only be treated with some reducing agent such as ammonium persulphate, which would reduce contrast without destroying the detail in the shadows.

Under-Development of Normal Exposures.

The opposite fault, under-development, which in connection with normal exposure is shown in Figs. 5 and 5A, may be remedied by intensification, which has approximately the same effect as further development would have had. But it must be remembered that intensification will only *strengthen* the detail that is in the negative; it does not *produce* detail. It is on this account of little value in connection with under-exposed plates. Such a negative, however, as Fig. 5 might be intensified by any of the ordinary methods, and would then give a more contrasted print. Of course, either of the over-exposed plates, Figs. 3 and 8, might be intensified, but they would then be so very thick all over that printing would be tedious and almost impracticable.

The Teaching of the Reproduced Negatives and Prints.

It will now be an advantage to tabulate the results we have been examining, thus :—

1. Under-exposed. Normally developed. Loss shadow detail.
2. Normally exposed. Normally developed. Correct result.
3. Over-exposed. Normally developed. Flat result.

4. Normally exposed. Over-developed. Harsh result. Might be reduced with persulphate.

5. Normally exposed. Under-developed. Too soft result. Might be intensified

6. Under-exposed. Over-developed. Harsh result; hopeless.

7. Under-exposed. Under-developed. Hopeless result.

8. Over-exposed. Under-developed. Flat result. Might be intensified.

From this table, as well as from the actual reproductions, we see that under-exposure is practically hopeless if at all serious. Considerable over-exposure may be dealt with by a careful worker who is a good manipulator, and under- or over-development of normal exposure may also be remedied by the use of suitable intensifier or reducer. With modern plates and films, I am convinced that the best all-round results will be obtained by studying exposure carefully and developing by time and temperature. Of course, the contrast present in the subject exercises an effect on the contrast in the resultant negative, but the subjects which show excessive contrast are few, and a slightly decreased time of development meets the circumstances. On the other hand, it will be seen that if an increase of contrast is desired, anything above the normal exposure should be avoided, and a very full development given.

Getting Contrast or Hardness.

It may be well to say something with regard to those cases in which a negative is required of a character completely different from the subject or the original, and three conditions may be taken; *first*, the production of a negative from an object; *second*, reproduction from a print, and *third*, reproduction from another negative. From what I have already said and from the illustrations, it will be clear that increase of contrast is secured by prolongation of development after a short exposure, or indeed, after any exposure until it is so prolonged that flattening of the lights occurs. But the increase of contrast is more noticeable with the shorter exposures. Sufficient exposure, however, must always be given to secure details in the shadows. It will sometimes happen that the subject is of such slight contrast that, with sufficient exposure, prolonged development only builds up a very thick negative, that is, all the tones increase in density and the difference between the highest light and the deepest shadow is not increased appreciably. This effect is, perhaps, most commonly met with in copying work, and when working on outdoor subjects in hazy weather or in feeble light. In many cases it is impossible to secure adequate contrast by development, and it is necessary to resort to the production of a thin but clean negative and to gain the desired strength by intensification. When it is possible to select the plate for the work in hand, it will be found that a very slow plate will enable the requisite quality of negative to be obtained by exposure and development alone, that is, without resorting to any

after intensification. Such brands as *process* or *ortho-process* plates are admirable for dealing with flat subjects of the kind indicated. Negatives which are extremely feeble may be reproduced by the aid of such plates and practically any strength obtained, as increase can be gained both in the transparency and final negative stages.

Securing Softness.

When very great softness and delicacy are wanted, the extra rapid plate is valuable. This is not to suggest that subjects of average strength cannot be adequately rendered by normal-exposure and development on rapid plates, but there is much less danger of getting too much contrast when working with a plate of great rapidity. The use of slow plates when vigorous negatives are required from soft subjects and of rapid plates where soft negatives are wanted of vigorous subjects, will simplify the negative maker's task considerably and prove a simpler method in what may be termed the extreme cases than mere variation in the time of development.

I have said nothing about the use of potassium bromide in the developer, because I rarely find it necessary with the particular brand of plate I generally employ. In cases where prolonged development is contemplated, however, I add one drop of a 10 per cent. solution to each ounce of the mixed developer and find it prevents fog and veiled shadows. In either normal exposure, where the maximum of contrast is desired, or in brief exposures, where a diluted developer is to be used to coax out detail, the addition of the bromide is a help towards clean, fog-free shadows.

OBITUARY OF THE YEAR.

Among those whose deaths have taken place since the publication of the 1913 ALMANAC are :—

George Houghton (July 20, 1913).
E. W. Foxlee (March 28, 1913).
Lord Crawford (Jan. 31, 1913).
Catherine Weed Ward (Mrs. Snowden Ward) (July 31, 1913).
A. H. Harman (June 1913).
A. D. Godbold (June 25, 1913).
W. I. Chadwick (June 6, 1913))
W. H. Prestwich (Nov. 1, 1912.
A. E. Staley (August 4, 1913).

GEORGE HOUGHTON.

Mr. George Houghton was the chairman of the board of directors of Houghtons, Limited, and was exceedingly well-known and respected throughout the whole trade. He was born in 1836 at 89, High Holborn, a couple of years after his father had joined partnership with Mr. Claudet. The firm of Claudet and Houghton held the sole rights for the then new patent process of photography (Daguerreotype), and anyone desirous of taking or producing photographs had to obtain a licence from the Houghton firm before they could do so. From the making of Daguerreotypes and the granting of licences for the process, the supplying and manufacturing of the various materials and apparatus required was a natural transition. Mr. George Houghton joined the firm in 1852 and the style became George Houghton and Son, a name which it retained until 1904, when it became Houghtons, Limited.

Mr. George Houghton's life was an exceedingly active and strenuous one and it was due to his great ability, powers of organisation and foresight that the photographic business of Houghtons, Limited, was increased in his lifetime from a department consisting of four persons to a large manufacturing and distributing business employing over 1,500 people. Mr. Houghton's personality was always a strong one, and his position as head of the photographic trade was due to his integrity and his high sense of justice. He was often appealed to by those in the photographic business, for his judgment and opinion were highly valued. As an employer he was held in affectionate regard by those who were closely associated with him.

It is sad to record that Mrs. Houghton survived her husband only a few hours, having been taken ill a day or two previous to Mr. Houghton's death, and dying on the same day at the age of seventy. Mr. Houghton was seventy-seven.

E. W. FOXLEE.

For over forty years Mr. E. W. Foxlee was associated with "The British Journal of Photography" as a contributor and reviewer. In his early days he was engaged professionally in photographic portraiture. He was a worker in the Daguerreotype process, and was actively connected with the progress of photographic processes through the days of collodion positives and wet collodion, and down to the era of dry-plate emulsions. Most of his work, however, concerned the carbon and other methods of bichromate printing, and for some years he was actively connected with the manufacture of carbon tissue by the Autotype Company. He was a life-long member of the Photographic Club. His interests covered a wide field. Apart from the practice of technical photography, to which he made many valuable contributions, he specially interested himself in the question of copyright protection of photographs, and many of the contributions in the "Journal" which kept photographers informed of their rights and liabilities under the Copyright Act of 1862 were from his pen. Of a retiring and most modest temperament, he was known only by name to perhaps the majority of the photographic world of recent years. At the time of his death, which took place after a painful illness of more than two years, Mr. Foxlee was over eighty years of age.

LORD CRAWFORD.

Distinguished in many ways as a man of science, an explorer, a sportsman, and a collector, Lord Crawford had very close associations with photography as president of the Royal Photographic Society, chairman of the Affiliation, and, at the time of his death, as president of the Camera Club. In particular the years of his occupancy of the presidential chair of the "Royal" will be remembered as the most prosperous and progressive of that body. Lord Crawford was not only a learned and scientific man: he was an excellent man of business, and his direction of the Society's affairs and of the proceedings of its council were characterised by great foresight and knowledge of human nature. Lord Crawford was president of the Royal Astronomical Society in 1878 and 1879, and was elected a Fellow of the Royal Society in 1878. He had much mechanical knowledge and skill, and his name is associated with a notable heliometer, which was made for his Mauritius expedition and afterwards passed into the custody of Sir David Gill at the Cape, and thence ultimately to Edinburgh.

Again, Lord Crawford was a great yachtsman and the owner of the steam yacht "Valhalla," in which he made a long and memorable voyage, from November, 1905, to May, 1906. During these months he visited South America, South Africa, Ceylon, and the island of Madagascar, and he carried the mails to the remote island of Tristan da Cunha. The voyage was not merely undertaken for pleasure; Lord Crawford made it a scientific expedition, and took with him, as he had done on a previous voyage, a trained ornithologist, and as a result thirty-four birds, representing sixteen species—some of which were great rarities—were presented to the Zoological Society.

Catherine Weed Ward.

Mrs. Snowden Ward survived her husband by little more than eighteen months. Since his decease she had continued to live at Golden Green, Hadlow, Kent, and failing health prevented her from undertaking any active work. She was one of the most enthusiastic amateur photographers, for though she began using a camera in 1888 and continued practising her hobby almost incessantly, she never lost the sense of pleasure in taking and making photographs, yet remained averse from the more recent developments in methods of photographic printing. Photographic journalism had an early attraction for her, and prior to her marriage and residence in England she was for some time managing editor of the American "Amateur Photographer" and a contributor on photographic topics to a number of the general journals in the United States. Of late years almost all of her photographic work was in the direction of obtaining records of scenes of literary or antiquarian interest. She made the great bulk of the illustrations of her husband's books and lectures on Dickens, Shakespeare, and Chaucer; the negatives accumulated for this purpose and in her previous travels in England numbered some 10,000.

A. H. Harman.

A. H. Harman was one of the pioneers in the commercial manufacture of gelatine dry plates and the founder of the Britannia Works Co., Limited, now Ilford, Limited. Of late years he had severed his connection with the technical and business interests which occupied him in middle life. He was a prominent churchman, and as a result of his generosity Grayswood, Haslemere, was, in 1900, made a separate ecclesiastical parish, with its own church and vicarage. The capital providing the endowment sufficient for an income for the incumbent of £300 a year was the gift of Mr. Harman, who at the time of his death was about seventy years of age.

A. D. Godbold.

For some years Mr. A. D. Godbold acted as editor and manager of the "Photographic Monthly," in succession to the late Snowden Ward, and on the suspension of that publication had been connected with several firms in the photographic trade. Only a few weeks before his death he had become connected with a photographic Press agency, and it was in the interests of that business that he took a journey to the north of Ireland, where he caught a severe chill which resulted in his death. A popular member of the London Camera Club, Mr. Godbold was esteemed in the many photographic circles in which he moved. At the time of his death he was only forty-five years of age.

W. I. Chadwick.

Councillor W. I. Chadwick, of Thornton, near Blackpool, was a notable personage in the amateur photographic world, and one of the best known writers and workers in microscopical and stereoscopic photography. He was also a prominent lecturer on photo-

graphy, and had delivered his lectures all over the country in aid of charitable objects.

W. H. Prestwich.

Mr. William Henry Prestwich was one of the oldest professional workers and experimenters in photography. His business career in Reading and London covered a period of over fifty years. His work in photography was not by any means limited to portrait making; he was also actively interested in the experimental side of emulsion making, in which branch of work he will perhaps be best remembered by his introduction of starch in the making of matt bromide papers. At the time of his death Mr. Prestwich was eighty-one years of age.

A. E. Staley.

For some four months prior to his decease Mr. Staley had been in a very critical state of health as the result of a paralytic seizure. His death removed a most prominent and popular figure from the ranks of photographic trading, and one, too, whose business connection with photography goes back a considerable number of years. Mr. Staley was formerly in the firm of Messrs. Chas. Reynolds and Co., wholesale dealers in fancy goods, and whilst with them established and conducted a photographic branch of the business. On going into business on his own account he first dealt largely in French rapid rectilinear lenses, and next with the between-lens type of shutter, of which he was one of the first in this country to sell large numbers. Subsequently Mr. Staley acted as agent of the Rochester Camera Co., and until the amalgamation of this firm with the Eastman Kodak Co., as manager of the London house. During the past few years his interests had been chiefly in the direction of the London business of the Bausch and Lomb Company. Of great energy and activity, the late Mr. Staley did not look his sixty-nine years.

Among others whose deaths have taken place during the past year are :—Hans Müller, an old and popular member of the Photographic club; W. Havey Barton, one of the first photographers in Bristol, and head of the art-publishing firm bearing his name; John Adamson, of Rothesay, one of the oldest professional photographers in the United Kingdom, Dr. Tempest Anderson, of York, and Joseph Epstein, member of the Bristol frame-making firm.

EPITOME OF PROGRESS.

BY THE EDITOR.

In the following pages will be found classified abstracts of papers, communications, and articles describing progress in technical photography (art topics are excluded) which have appeared in the British and foreign Press during the twelve months October 20, 1912, to October 20, 1913. It may have happened that some foreign journals have not arrived in time for abstraction; their contents will be dealt with in the 1915 ALMANAC.

The general arrangements of the Epitome will be seen from the contents of the ALMANAC, which follows the title-page. Each item is separately entered in the index at the end of the volume, and a list of the journals abstracted will be found at the conclusion of the Epitome.

In a number of cases where information additional to that in the abstract has appeared in the "British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

EVENTS OF YEAR 1913.

Jan. 13.—Award of the R.P.S. Progress Medal to Dr. C. E. K. Mees for his researches, discoveries, and publications in the physics and chemistry of photography.—("B.J.," Jan. 31, 1913, p. 77.)

Jan. 14 to Feb. 22.—Exhibition of photographs by A. H. Blake at the Royal Photographic Society.—("B.J.," Jan. 24, 1913, p. 68.)

March 1 to 22.—Tenth Scottish Salon. Held at Paisley.—("B.J.," March 7, 1913, p. 175.)

April 1 to May 17.—Exhibition of photographs by Dr. E. G. Boon at the Royal Photographic Society.—("B.J.," April 11, 1913, p. 289.)

April 4 to 12.—Photographic Arts and Crafts Exhibition. Organised by Arthur C. Brookes at the Horticultural Hall, Westminster.—("B.J.," April 4, 1913, p. 262.)

April 4 to 12.—Fifth Exhibition of the Society of Colour Photographers. Held at the Horticultural Hall, Westminster.—("B.J." Colour Supplement, April 4, 1913, p. 14.)

April 7 to 11.—Fourth Congress of the Professional Photographers' Association. Held at the Horticultural Hall Westminster, under the presidency of Richard N. Speaight. The proceedings are reported in the "B.J." for April 11 and 18, 1913. A reproduction of a group of members appears in the "B.J." for April 18, 1913, p. 300.

July 7 to 12.—Twenty-eighth meeting of the Photographic Convention of the United Kingdom. Held at Bangor under the presidency of F. J. Mortimer. The proceedings are reported in the "B.J." for July 11 and 18. The 1914 meeting will be held at Perth.

August 25 to Oct. 4.—Fifty-eighth Exhibition of the Royal Photographic Society. Held at the Royal Society of British Artists, Suffolk Street, Pall Mall, S.W.—("B.J.," Aug. 29, 1913, p. 664.)

Selecting and Hanging Committees:—Pictorial Section: John H Gear, H. Holcroft, F. T. Hollyer, Charles Job, Furley Lewis, Arthur Marshall, J. C. S. Mummery, and J. B. B. Wellington. Scientific and General Section: W. Deane Butcher, C. P. Butler, Chapman Jones, Richard Kearton, F. Martin-Duncan, A. J. Newton, and J. W. Ogilvy. Colour Transparencies: John H. Gear and H. Essenhigh-Corke.

Sept. 6 to Oct. 18.—Fourth Exhibition of the London Salon of Photography. Held at 5a, Pall Mall East, S.W.—("B.J.," Sept. 12, 1913.)

BUSINESS.

New Illingworth Factory.—A description of the new factory at Park Royal, Willesden Junction, London, N.W., erected by Messrs. Thomas Illingworth and Co., Limited, for the manufacture of printing papers and for photographic enlarging, etc., is given in "B.J.," Sept. 19, 1913, p. 726.

Shops Act.—According to two decisions in County Courts in the North of England, a doorman, who mainly touts for business outside a studio, has been held to be a "shop assistant" within the meaning of the Shops Act.—"B.J.," Dec. 13, 1912, p. 965.

Rise in the Price of Plates.—By agreement among the British manufacturers of dry plates an increase in the price of plates to the amount of roughly 25 per cent. on the retail price was made on June 16, 1913. The following firms were signatories to the revised tariff:—Birmingham Photographic Co., Limited, Cadet and Neall, Limited, Elliott and Sons, Limited, Ilford, Limited, Imperial Dry Plate Co., Limited, Gem Dry Plate Co., Limited, Kodak, Limited, Leto Photo Materials Co., Limited, Marion and Co., Limited, Mawson and Swan, Limited, Paget Prize Plate Co., Limited, Wellington and Ward, Wratten and Wainwright, Limited. These it will be seen comprise the whole of the British manufacturers.—"B. J.," June 20, 1913, p. 472.

COPYRIGHT.

Copyright in Engravings.—The existence, or otherwise, of copyright in engravings, such as photographers are frequently asked to reproduce, depends upon various conditions. In this respect engravings may be classified as follows:—

1. Original engravings, *i.e.*, those in which the design or subject is the original work of the engraver. Previous to the 1911 Act the copyright in these lasted for twenty-eight years from the publication of the engraving. It may, therefore, be known (from the date which the engraving was required to bear) whether copyright had expired previous to the 1911 Act coming into force on July 1, 1912. If copyright had not expired by that date, that is, if the engraving was first published subsequent to July 1, 1884, the term of copyright is prolonged by the 1911 Act to the full term of the life of the author (engraver) and fifty years after his death.

2. Engravings from paintings, etc., in which there was no copyright at the time the engraving was made, or from those in which the copyright in the original has since expired. The protection obtained by an engraving in these circumstances is the same as those of Class 1, and the same precautions are necessary in making copies.

3. Engravings made from paintings etc., in which copyright may still subsist. In this case copyright in the engraving may have expired yet it will be an infringement of the copyright in the original painting to copy the engraving. In the case of such engravings the photographer has no need to trouble about the existence, or otherwise, of copyright in the engraving; he must consider that in the original painting. If the author of the latter died more than seven years before July 1, 1912, copyright in the painting has expired, but if the author died less than seven years before July 1, 1912, the copyright is prolonged to the full term of the life of the author and fifty years after his death—that is, for a further forty-three years from July 1, 1912.—"B.J.," May 16, 1913, p. 375.

Innocent Infringement.—The first case to be heard since the coming into force of the 1911 Copyright Act, in which the defence of innocence was put forward by an infringer, was heard in the Lancaster County Court, February, 1913. A photographer named Davis had taken a portrait of a superintendent of police. The copyright of the portrait was his, and the police official, on his retirement, had given a copy of the portrait to a firm of photographers, Fletcher and Colville, who were also local agents for the supply of photographs to the Press. They supplied prints of the portrait to the "Barrow News and Mail," in which paper it appeared, and was acknowledged to them. Mr. Davis then sued the proprietors of the newspaper, who pleaded innocence on the ground that the firm from whom they received the photograph were the owners of the copyright. Counsel for Mr. Davis, however, laid stress upon the clear wording of the Act that in such plea of innocence it is necessary for a defendant to prove that "he was not aware and had no reasonable ground for suspecting that copyright subsisted in the work." Judgment was given for Mr. Davis. The report of the case appears in "B.J.," Feb. 14, 1913, p. 122, with comments upon it p. 115.

II.—APPARATUS AND EQUIPMENT.

(Including Raw Materials Used in Photography.)

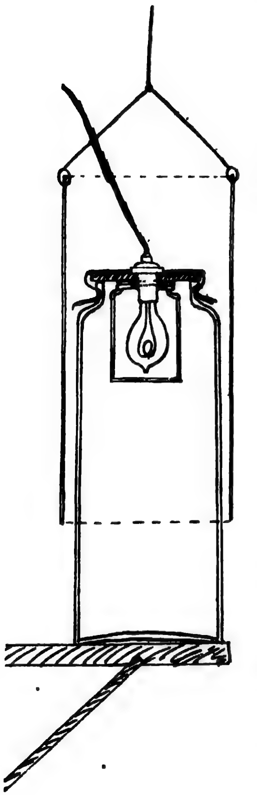
The many details of pieces of apparatus published chiefly in patent specifications are not abstracted in this Epitome, as space does not permit of the numerous drawings necessary for their explanation. All patent specifications are abstracted in the "British Journal of Photography," and are entered according to subject and also under the name of the patentees in the index to the yearly volume of that publication, which is issued with the last number of the year or the first of the year following.

Dark Room and Studio.

Quick-Working Dark-Room Blind.—Working directions are given for the making of a quick-acting dark-room blind, the material for which is mounted on rollers placed respectively at the top and bottom of the window-frame, their movement being operated by stout tapes kept in tension by a powerful spring.—"B.J.," Sept. 12, 1913, p. 699.

Dark-Room Lamp and Clock.—E. G. Pückler has described a form of dark-room lamp into the front (vertical) wall of which a clock dial is fitted, and is illuminated by the electric lamp within. The pointers on the dial are actuated by a clockwork mechanism at the rear of the lamp, the movement of the pointers being effected by a long pinion. A safelight is provided on the under-side of the lamp, which can thus be used for development, whilst the indication of the clock is clearly seen.—Eng. Pat. No. 25,324, 1912; "B.J.," Sept. 5. 1913, p. 690.

Bichromate Dark-room Lamp.—G. F. Greenfield describes a convenient form of the bichromate dark-room lamp, the novel feature of which is a shade which can be caused to cover the whole or part of the lamp.



The outer jar is a round, wide-mouth sweet-bottle, some 14 inches high, and costing 9d. The inner one is a wide honey jar, with a screw cap (any such jar will serve if its depth be not greater than five inches). The space between the two jars is filled with a saturated solution of potass bichromate, with a few crystals at the bottom; no addition of dye is necessary. Finally, the lid (of waxed wood) shown in the sketch is tied down with strong waxed paper, keeping the inner jar in place and preventing evaporation.

The shade which surrounds the lamp is of cardboard, and hangs by a cord which, passing over a pulley, has a counter-weight at the other end. This shade fits very loosely, and serves the double purpose of keeping the direct rays out of the eyes and of regulating to a nicety the light on the work. If desired, the back of the lamp may be painted or papered white, but this is not at all necessary, as a soft and comfortable light is emitted in all directions from the lower part of the lamp.

The most convenient position for the lamp is about 15 inches above the sink, standing on a narrow shelf, which projects about a foot from the back. This position enables plates and prints to be examined by transmitted as well as by reflected light—a matter of great importance in judging density.

The light passed through three inches of bichromate solution is only the red, yellow, and a very small amount of the yellow-green. An extra rapid plate exposed at six inches from the lamp, the shade five inches up from the base, for five minutes, showed no trace of fog on development.—"B.J.," March 14, 1913, p. 196.

Electric Wiring for Red and White Light.—E. J. Hudson advises placing the switches for white light in a dark-room, or factory coating room, at a height of at least 6ft. 6in. from the ground, so that the workman has actually to reach for them. Mistakes are thus impossible. In every case the "white" switches were fixed immediately above the "red" ones, and on the same piece of casing

or conduit. The "red" switches are, of course, fixed at the usual height—3ft. 6in. or thereabouts.

Fig. 1 illustrates the comparative positions of the switches and lights, and an economical method of connecting up the wires. W and R are the white and red lights respectively, and W¹ and R¹ the

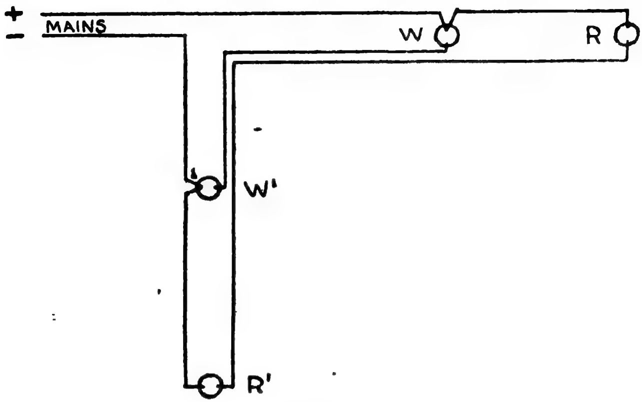


Fig. 1.

switches controlling them. The positive wire, +, is taken to one side of the lampholder W, and looped from the same side to the lampholder R. The negative, —, is similarly connected to one side

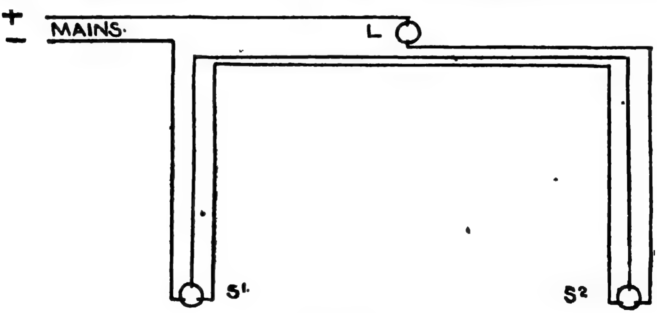


Fig. 2.

of the switch W¹, and looped on to R¹. The circuits are completed by means of a wire from each light to its respective switch.

Fig. 2 illustrates the method of wiring up two switches in such a way that any light may be controlled from two different positions. It is, for example, frequently desired to have a means of switching

on a light from either end of a room, from the top and bottom of a flight of stairs, or from both sides of a lobby dividing two rooms. S^1 and S^2 are a special type of switch, known as two-way switches, which can be bought at any electrician's. Each switch is provided with three terminals, instead of two as in the ordinary way. L is the light. The positive wire, +, is taken direct to the light, and the negative, —, to the nearest switch, in this case S^1, and is connected to the busbar side, which can be easily determined when the switch is handled. The busbar of the switch S^2 is connected to the second terminal at L, and the circuit completed by means of wires connecting the two remaining terminals of each switch.—"B.J.," April 25, 1913, p. 325.

Security Switches.—W. Foster Brigham advises the erection round the switches for white light of a "fence" consisting of a frame made of half-inch board and about two inches deep. It is fixed to the switch block so as to project sufficiently to allow the switch knob just to move up and down. Thus, the finger has to be pushed over or under the "fence" in order to actuate the switch, and the device serves as a quite satisfactory preventive of accidental switching on of white light.—"B.J.," May 2, 1913, p. 349.

Cheap Blackening of Brass.—The following is an old, but little known, method of cheaply blackening brasswork. The solution is made as follows:—

Water	160 ozs.
Sugar of lead (lead acetate)	8 ozs.
Hyposulphite of soda	8 ozs.

The solution is used as hot as possible, and the brass work is simply dipped in it, and allowed to remain until black. This takes about a minute or less. The articles are then rinsed in cold water, then in hot water, and dried. If scratch-brushed dry, the black deposit will have a high lustre.

When dipped into the solution, the surface of the brass article becomes yellow, then blue, and finally black. The article should not be taken out until all the surface has become blackened. The deposit on it is sulphide of lead. The articles should always be lacquered, otherwise the black deposit is likely to oxidise and fade; but if coated with lacquer, it seems to be quite permanent.

For a cheap class of goods that require a black finish, this solution can frequently be used to a good advantage. It requires no electric current, being used as a dip. The colour is not coal black, but resembles a graphite black more than anything else, and has a slight grey shade. It is sufficiently black, however, to answer many purposes, and it is so easily applied that it can be used on cheap goods with only a slight increase in cost.—"B.J." (from "Brass World"), Nov. 1, 1912, p. 845.

Fireproofing Fabrics.—W. H. Perken gives the following method employed in the fireproofing of fabrics:—The material is impregnated with a solution of sodium stannate of about 45 deg. Tw., squeezed,

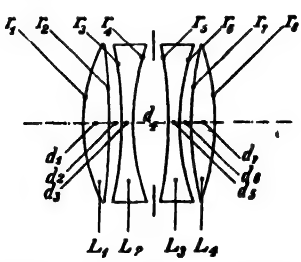
dried on heated copper drums, passed through a solution of ammonium sulphate of about 15 deg. Tw., in order to precipitate tin oxide, again squeezed and dried, washed to remove sodium sulphate, dried, and finished in the usual way. The tin oxide is probably present in actual combination with the fibre, for the fire-proofing is not destroyed by repeated washing with hot water and soap. The process is also applicable to the treatment of muslin, lace curtains, etc. The cost works out to about one penny per yard. —"B.J." (from Journ. S.C.I.), Dec. 13, 1912, p. 965.

Lenses and Photographic Optics.

Optical Glass.—H. E. Howe, chemist to the Bausch and Lomb Optical Company, has described, in a paper before the American Optical Association, the historical development of modern optical glass, chiefly by Schott and Abbe. He describes the methods of making the optical glasses and deals with their chemical and physical properties.—"B.J." (from "Optician"), Aug. 8, 1913, p. 608.

Large-Aperture Anastigmat Doublet.—C. P. Goerz Actien Gesellschaft have patented the construction of a doublet lens (corrected as regards spherical and chromatic aberrations, astigmatism, and coma), each member of which consists of a positive lens of highly refractive baryta-crown, and a negative lens of less refractive power, the two lenses being separated by an air space in the form of a positive meniscus.

The object of the invention is to improve the quality of the image produced by lenses of this kind, more particularly to reduce the coma error. This purpose is primarily attained by a special shaping of the negative lenses of the two objective members. This consists in making, in the two negative lenses, the border surfaces of different curvatures and arranging the lenses in relation to the diaphragm so that the more strongly curved surface of the negative



lens in the front member, and the less strongly curved surface of the negative lens in the rear member, are directed towards the diaphragm. For obtaining the best results the front member of the objective should have a greater focal length than the rear

member, but not exceeding twice the focal length of the latter. This disposition of focal lengths has the advantage that in normal use of the objective in a camera of the bellows type the length of the bellows is sufficient to enable each objective member to be used separately. Such separate use is possible, inasmuch as the two objective members, though not individually corrected, furnish useful pictures if considerably stopped down.

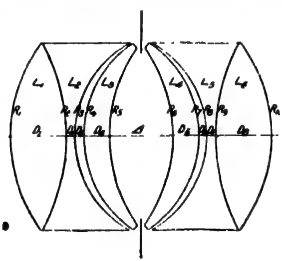
The following are the constants in one example of an objective constructed according to the invention, with focal length 1 = 100 :—

$r_1 = +\ 27.701$	$d_1 = 4.2$	$n_D = 1.61412$	$n_{G^1} = 1.62803$	$C-F = 0.01090$
$r_2 = -\ 103.093$	$d_2 = 1.8$			
$r_3 = -\ 55.909$	$d_3 = 1.6$	$n_D = 1.56890$	$n_{G^1} = 1.58637$	$C-F = 0.01335$
$r_4 = +\ 37.736$	$d_4 = 5.4$			
$r_5 = -\ 63.291$	$d_5 = 1.6$	$n_D = 1.54820$	$n_{G^1} = 1.56364$	$C-F = 0.01188$
$r_6 = +\ 35.028$	$d_6 = 1.8$			
$r_7 = +\ 53.191$	$d_7 = 3.6$	$n_D = 1.61412$	$n_{G^1} = 1.62803$	$C-F = 0.01090$
$r_8 = -\ 35.690$				

The aperture ratio is 1 : 4.5.—Eng. Pat. No. 883, 1913; "B.J.," March 21, 1913, p. 231.

Anastigmat Lenses of Light Flint Glass.—E. Arbeit has patented a lens construction in which light crown glass may be replaced by light flint and an aplanatic anastigmat still obtained.

The invention relates to photographic lenses consisting of a positive meniscus and of a double lens separated from the same by an air space and consisting of an outer biconvex and an inner biconcave glass. Lenses of this type have been made with the outer components of the whole combination formed of heavy crown



glass, the inner, biconcave lens being of baryta light flint. The invention consists in the two outer lenses of the whole three-lens object-glass being constituted by baryta light flint glass, and the central one by an extra light flint glass of still smaller refractive index, the *nu* value of which is smaller than that of the two adjoining lenses. The names "baryta light flint glass" and "extra light flint glass" correspond to the nomenclature in the published price lists of the Jena Glass Works of Schott and Gen.

The optical elements of such an object glass, for a focal length F=240 mm., with a diaphragm ratio 1: 6·8, are as follows:—

			n_D	n_G
$R_1 = R_{10} = 44 \cdot 53$				
	$D_1 = D_8 = 6 \cdot 04$	$L_1 = L_6 =$	1·58030	1·59416
$R_2 = R_9 = 70 \cdot 87$				
	$D_2 = D_7 = 2 \cdot 82$	$L_2 = L_5 =$	1·54081	1·55550
$R_3 = R_8 = 30 \cdot 18$				
	$D_3 = D_6 = 0 \cdot 81$	$L = L =$	1	1
$R_4 = R_7 = 33 \cdot 54$				
	$D_4 = D_5 = 4 \cdot 03$	$L_3 = L_4 =$	1·57180	1·58643
$R_5 = R_6 = 49 \cdot 09$				

Δ *i.e.* the distance between the two halves of the objective = 12.88

The small deviations in the glass constants of the lenses L^1 and L^3 have been intentionally selected in the construction given; it goes without saying that the lenses could also be made of one and the same kind of glass without in any way departing from the spirit of the invention.

The diagram shows two optical systems according to this invention combined to form a double object glass.—Eng. Pat. No. 16,331, 1912; "B.J.," Jan. 17, 1913, p. 51.

Separated Anastigmat Lenses.—H. Dennis Taylor has patented a reversal of the type of lens construction (Patent No. 22,607, 1893), which consisted briefly in placing a negative lens between and separate from two positive lenses, so arranged that the power of the negative lens was approximately equal to or slightly less than the sum of the powers of the two positive lenses, and this, if carried out with true regard to the attainment of the condition of freedom from spherical aberration for the axial image, a flat anastigmatic image and freedom from the coma for the oblique pencils, produced various photographic lenses of very fine quality.

The present invention chiefly consists in reversing the old arrangement and placing the simple or compound positive lens in the middle between and separate from the two negative lenses, so arranged that the power of the positive lens or lenses shall be either slightly less, equal to, or slightly greater than the sum of the powers of the two negative lenses, while the conditions of astigmatic flatness of image and freedom from coma in the oblique pencils and rectilinearity of image are attained.

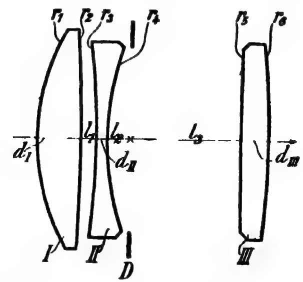
The first claim, according to the present specification, is:—

A separated lens system constituting an objective for camera, lantern projection, or microscopic work, consisting of two outer unequal negative lenses, enclosing two unequal and unsymmetrical positive lenses, if built up of only four lenses, or of two approximately symmetrical outer negative lenses enclosing three or four (preferably) symmetrically arranged positive lenses, if built up of five or six lenses, or enclosing one compound positive lens; the sum of the powers of the two negative lenses being approximately

equal to the sum of the powers of the enclosed positive lenses, the whole being corrected to project a flat anastigmatic image of objects lying in a plane at any distance for which the combination is constructed, by which relative arrangement of negative and positive lenses we cause the two nearest principal points of the respective halves of the combination, when they are put together, to pass and overlap by a considerable distance, thereby very largely gaining in focal power for the combination. For a consideration of the principles and details of construction of these new lenses, the specification, which does not admit of ready abridgment, should be consulted.—Eng. Pat. No. 3,799, 1912; "B.J.," Mar. 21, 1913, p. 232.

Three-Lens Anastigmat.—Carl Zeiss has patented a photographic objective consisting of a dispersive single lens and of two collective single lenses, one of which latter lenses lies in front of the dispersive lens and the other one behind it, the refractive index of the dispersive lens lying between the values 1·545 and 1·565. An objective of this type has become known through the Patent No. 15,107, 1895, and is there dealt with in Series V. (Fig. 10). This well-known objective has the aperture-ratio 1 : 7·7, and is so far corrected as regards astigmatism that for an inclination of the pencils on the side nearest the object amounting to about 28° with regard to the axis there remains an astigmatic difference of 2 per cent. of the focal length of the system.

According to the invention the correction as regards astigmatism may be substantially improved without rendering a good correction



of the spherical and the chromatic aberrations impossible, by considerably increasing as compared with the objective in question the distance between the dispersive lens and the lens lying in front of it. While in the well-known objective this distance amounts to only a little more than one-third of one per cent. of the focal length of the system, in the new objective it is not less than two-thirds of one per cent. and not greater than 1½ per cent. of the focal length of the system.

In the new objective, along with the spherical correction and the correction in respect of the sine-condition for an aperture ratio of 1 : 6·3, such a correction of the astigmatism and of the curvature of the image-field may be obtained that up to an inclination of

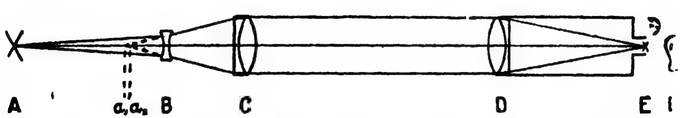
the pencils on the side nearest the object amounting to about 28° with regard to the axis the astigmatic difference and the deviation of both image surfaces from the ideal focal plane nowhere reach the amount of one per cent. of the focal length of the system.—Eng Pat. No. 6,328, 1913; "B.J.," July 4, 1913, p. 519.

Four-Lens Anastigmat.—C. F. Lan-Davis has patented the construction of a large-aperture anastigmat lens consisting of four glasses, two uncemented in front of the diaphragm, and two cemented behind the diaphragm, the positive lenses in both front and back combinations being made of glass of low dispersion and of high refractive index, and the negative lenses being made of glass of medium refractive index and medium dispersion.

The invention relates on the one hand to a system composed of thick meniscus lenses in which the crowns are made of glass of high refractive index and low dispersion, and in which both the flints are made of glass of medium refractive index and medium dispersion. The focal length of the front combination is weakly positive, infinite, or weakly negative, and that of the back combination is strongly positive.—Eng. Pat. No. 27,518, 1912; "B.J.," Aug. 29, 1913, p. 674.

TELEPHOTO LENSES.

Testing Focal Length of High-power Negative Lenses.—The report of the National Physical Laboratory for 1912 describes the improved method adopted in determining the focal length of high-power negative lenses. Owing to the dimness of the light reflected from the mirror, which forms the image to be observed, compared with that which is scattered, and to the very small size of the image, the method hitherto employed was very trying to the eye of the observer, and to ensure accuracy it was usually found desirable to have these lenses examined by two different individuals. By arranging the lenses as shown in the accompanying figure, the negative lens and the auxiliary lens form a "telephotographic" combination. The ordinary collimator is used. Although with this arrangement the limits within which the lens must focus sharply are closer together than with other methods, it is found that the results are more certain, for it is very easy and comfortable to observe the large image of the cross lines that is thus secured, and also the image entirely disappears when the lens under test is



moved very slightly from the position of sharp focus. At A are the cross lines on which an image of the cross lines E at the focus of the collimator D is to be formed. B is the lens under test, C the auxiliary lens, and F is the lamp illuminating the cross lines E. The lens C is in such a position that the parallel beam from

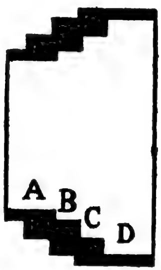
the collimator is brought to a focus at a_2 when the lens B is removed. When a lens of thickness t, refractive index μ and focal length $-f$ is interposed so as to bring the image of the cross lines E into coincidence with A, we have A $a_1 = f(m + \frac{1}{m} - 2)$ where m is the magnification at which the lens B is working and a_1 is the position of a_2 compensated for the thickness of the lens B, *i.e.*, $a_1\,a_2 = t\,\frac{\mu - 1}{\mu}$ very approximately, so that $Aa_2 = f\,(m + \frac{1}{m} - 2) + \frac{t\,(\mu - 1)}{\mu}$. The procedure adopted then is as follows: the lens C used alone is arranged to bring the image of E into sharp focus at A, and is then displaced through the distance $f\,(m + \frac{1}{m} - 2) + \frac{t(\mu - 1)}{\mu}$ where f, m, t and μ are known. When a lens B is inserted, if its focal length is f it will bring the light to a focus when its second unit plane is at a distance $f\,(m - 1)$ from A. The exact distance is measured on the tape of the bench, and if the position so found is different from that corresponding to the nominal focal length, the correct value of the focal length F is found from the equations $F\,(m_1 - 1) = f\,(m - 1) + x$ and $F\,(m_1 + \frac{1}{m_1} - 2) = f\,(m + \frac{1}{m} - 2)$, where x is the excess of the actual distance of B from A when the lines are sharply focussed, over the nominal v lue for this distance. This gives $m_1 = \frac{m\left\{f\,(m - 1) + x\right\}}{f\,(m - 1) + m\,x}$ and $F = \frac{\left\{f\,(m - 1) + x\right\}\left\{f\,(m - 1) + m\,x\right\}}{f\,(m - 1)^2}$. As an illustration of the values it is convenient to adopt, we take $m = 11$ for a -20 D lens. With $t = 0{\cdot}9$ mm. and $\mu = 1{\cdot}5$, we have $Aa_2 = 45{\cdot}48$ cm., and if $x = 0{\cdot}5$ mm., $F = f + x\,\frac{m + 1}{m - 1} + \frac{m\,x^2}{(m - 1)^2\,f} = 5{\cdot}06$ cms., the last term being negligible. It is evidently convenient to adopt a high value of m, and this also gives a convenient image for observing.—" B.J.," May 23, 1913, p. 401.

Cameras and Accessories.

Lens Hood for Pocket Cameras.—E. A. Salt, in a paper before the Croydon Camera Club, describes a ready means of making a light and portable lens hood suitable for cameras of the vest-pocket size. The figure shows the hood to scale. It is constructed out of four rolls of cartridge or other paper of good quality, and is light and remarkably stiff. An iron or other metal tube about

2 ins. long must first be procured, and turned down to exact diameter of the lens cell; ½ in. so treated at one end will be ample. Using this as a mandril, the tube A is made, bearing in mind that the thickness of its walls must be such as not to foul the speed indicator or setting lever, which sometimes comes close to the lens cell; in any case, it is advisable to keep this tube fairly thin. A narrow strip of paper is taken, soaked in water, blotted off, and a good adhesive, such as Higgins's, applied. It is then wound evenly round the mandril and at once slipped off to dry; it is not necessary to wind very tightly, as the paper will contract in drying. The coils B, C, and D are next built up in similar fashion, and the greater the diameter of C, the more D may project without cutting off light at the corners of the plate.

When completed, the hood should make a fairly tight fit on the mandril; if too tight, it is eased with sandpaper. No measurements, of course, can be given, either actual or relative, to meet all cases, as they will vary with the diameter of the lens cell and

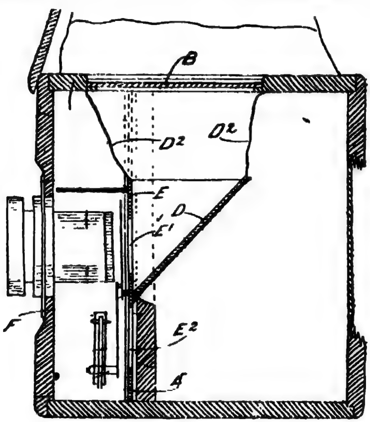


the aperture of the lens. The best plan is to build up a rough experimental model, using dry strips of paper held together with touches of glue or "Mendine" here and there, when by adding to, or cutting away, the right proportions will soon be arrived at. To ascertain whether any direct light which should reach the plate is being obstructed, the lens should be set at "infinity," the focussing screen or back removed, and an eye sighted along the corners. If nothing is seen, D may be lengthened tentatively, or if seen it may be shortened, until the right amount of its projection beyond C is found. If the camera has rising fronts, it must not be forgotten to test with these in use.

The size having been determined, and the composite tube made, it is coated inside and out with black water-colour paint, and when dry two or three coats of celluloid varnish can be given. A "dead black," is then applied Finely ground lampblack in powder, as sold by artists' colourmen, mixed fresh with celluloid varnish, affords a beautiful matt surface. Finally a hard lead pencil is taken, and the inside edge of A worked round to a depth equal to the projection of the lens cell, which will ensure the lens hood engaging smoothly with it. A coating of black enamel to the outside will improve its appearance.

The hood should always be taken off, and replaced, with a slight rotary movement "clockways," so as not to unscrew the lens cell in its mount, and here a word of caution may not be out of place:—The testing as to fit during construction should be made on the mandril, not on the lens cell, or the latter may be jammed. To minimise any tendency in this direction, it is a wise preliminary precaution to put a *trace* of good oil, such as clock oil, on the thread; but with the very slight projection allowed in many pocket cameras it may, in any case, be found difficult to remove the front combination for cleaning, as the fingers can get but little purchase. Without saying that it will loosen a tightly fixed cell, a plain paper tube constructed out of two coils, and made to fit very tightly, will generally serve for this purpose. This, of course, should be *placed on*, and rotated with a reverse motion to that indicated, the front being held firmly, so that any pressure applied may not be communicated to other parts of the camera.—"B.J.," Aug. 22, 1913, p. 645.

Reflex Camera.—H. Major and C. H. Gore have patented a camera of the reflex type in which the mirror is placed close behind the lens, is mounted to move vertically up and down, and is connected by a light-tight flexible bag with the focussing screen. Thus, the mirror box and focussing screen form a chamber from which light cannot get into the other interior part of the camera.



Normally the mirror-chamber is in its lowermost position, and light will enter through the lens and the orifice e^1 in the sliding front, so that rays may be reflected from the mirror to the focussing screen *b*. To effect exposure, the exposure arm is moved to raise the sliding front *e* supporting the mirror-chamber until the orifice e^2, normally closed by the shutter, is brought into line with the lens-

aperture, and at this point the shutter is automatically released. The two orifices in the sliding front are so close to one another that the object may be viewed on the focussing screen almost up to the moment of exposure. Eng. Pat. No. 28,528.—"B.J.," Feb. 7, 1913, p. 104.

Studio Reflex Camera.—A. L. Adams and B. Foulkes-Winks have patented a description of reflex camera in which the focussing-screen is placed vertically in the side of the camera, the mirror likewise having its axis vertical—that is, moving in a horizontal plane. A hood for viewing the image is provided, and in it is an aperture, covered with blue glass, through which the sitter can be observed directly when using the camera.—Eng. Pat. No. 19,406, 1912; "B.J.," Sept. 19, 1913, p. 730.

Instantaneous Shutters.—Arthur S. Newman, in a paper before the Royal Photographic Society, has reviewed the methods of construction of instantaneous shutters, tracing the evolution of these pieces of apparatus from the earliest drop shutters to the modern focal-plane and between-lens instruments.—"Phot. Journ.," June, 1913, p. 220. "B.J.," July 11, p. 534, and July 18, p. 550, 1913.

A Simple Studio Shutter.—G. Auwin has described a simple form of studio shutter to be attached (inside the camera) to the lens panel. This is done by the pair of hooks, one of which G is shown in Fig. 1. The shutter consists of the box seen in Fig. 1 provided

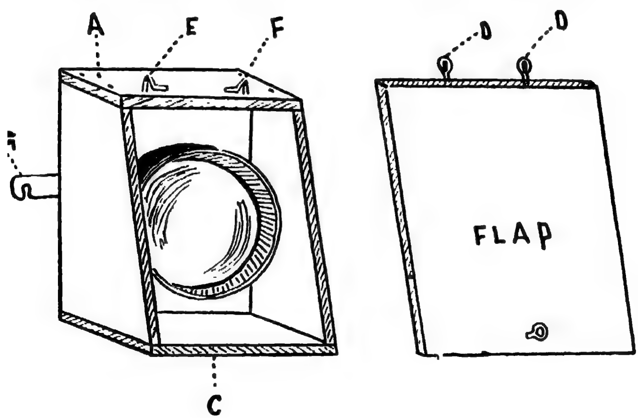


Fig. 1.

Shutter-box and flap. G is one of two hooks attaching shutter-box to camera front. D D, screw-eyes which are slipped over bent nails E and F, and attach flap loosely to box.

with a round hole (through which the lens may project) and, at the back, with an opaque flap which is very lightly hinged to the box. A very free moving hinge consists of an ordinary screw-eye attached

to a hook of bent wire (see DD and EF, Fig. 1, also in detail Fig. 2). The shutter is actuated by a string attached to the flap as shown in Fig. 3. The string is guided by two screw-eyes, one on the inside

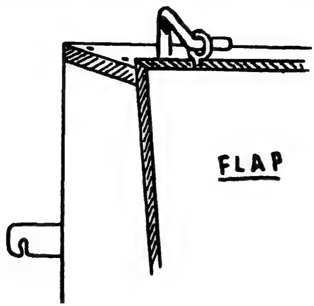


Fig. 2.
Detail of loose hinge—D D and E F in Fig. 1.

of the camera back at the top and the second at the right-hand top corner of the camera back. The string is then led out through the bottom of the camera back, a fine hole made with a thin bradawl

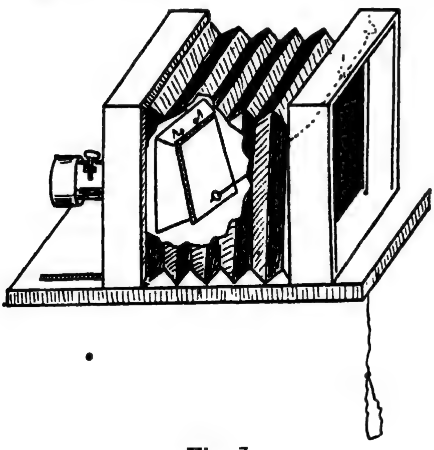
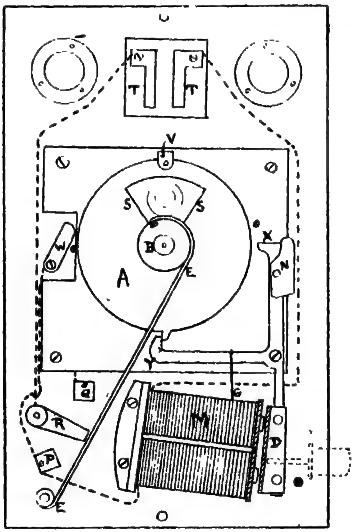


Fig. 3.
The shutter in use—opened by drawing string and closed by releasing the same.

being found to be without effect upon the plate, although, if necessary, a velvet sleeve through which the string may pass is very readily fitted to the outside of the camera.—" B.J.," Jan. 17, 1913, p. 39.

Electric Shutter Release.—E. F. Relf recommends a pattern of electric shutter release on the score of freedom from vibration and readiness of operation from any distance. The exposure is made by rotating disc A, which has a sector S S cut away. The disc is rotated by a piece of elastic, E E, which works on the barrel B, which latter, by the way, is the mainspring barrel of an old watch. The motion of the disc is controlled by the lever X Y, the lower end of which carries a soft-iron armature D, which is attracted by the electro-magnet M when the current passes. The shutter is set from the front of the camera by turning a milled head, which is on the same spindle as the disc A and the barrel B. The milled head is turned until the projection F on the disc catches on the end X of



the lever, and is thereby prevented from returning. A piece of fine elastic, G, serves to keep the lever X Y in position, *i.e.*, with the armature D away from the magnet. If now a current passes, the magnet M attracts D, and thus releases F from the end X of the lever. The disc A rotates a quarter turn, and the projection F catches on Y, which is now raised. The shutter will therefore remain open as long as a current passes through the magnet. Directly the current is stopped, the magnet loses its hold of D, and the elastic G pulls down the end Y of the lever, enabling the disc A to make another quarter turn, thus closing the shutter.

The thick dotted lines in the diagram show the electrical connections, and it will be seen that the above occurs when the switch R is on the contact P, the current then passing direct to the magnet from the springs TT, which communicate with the battery. If,

however, the switch is on the contact Q, the current proceeds from the spring T to R, thence to the contact Q, and then by way of the metal base-plate U to the projection V on the disc. This, when the shutter is set, is in contact with the spring W, and the current can pass from this to the magnet and thence back to the other spring T. But the moment the shutter moves, the circuit is broken by the projection V breaking contact with W. Therefore, before the projection F arrives at the end Y of the lever the magnet will have ceased to act, and the lever XY will be in its original position. Thus F will not catch on Y, and the disc will make a half-revolution, giving a snapshot.

With respect to the springs TT, when the front of the camera is in place, these make contact with two screw-heads on the camera itself, and these are connected to two spring sockets on the side of the camera, to which the wires from the battery are conveniently connected. This provision enables the front of the camera to be removed without disconnecting any wires.

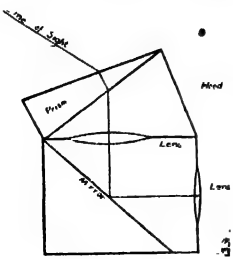
An ordinary 4½-volt flash-lamp refill battery will work for many months before requiring renewal. The battery may be permanently fixed on the back of the camera, and only the wires to the press button attached, when required, to the spring sockets.

This simple shutter has only the one speed for snapshots, which is fixed by the tension of the elastic EE and the weight of the disc A. It is easy to give time exposures as short as ⅛th second by making the press button so that the motion of the knob is very small.

The shutter can be released by hand, independently of the electrical mechanism, by a button (shown dotted in the diagram), the inner end of which bears on the back of the armature D.

The counter-weight N on the upper end of the lever X Y balances the weight of the armature D, and thus ensures that the shutter shall work equally well in either the vertical or the horizontal position. In the diagram the shutter is shown open.

Some device is, of course, necessary to prevent light from entering the camera while the shutter is being set. A cap, on the lens, is perhaps the simplest way out of the difficulty. With a little more trouble a simple sliding shutter can be arranged on the front of the lens, operated by drawing out a knob on the side of the camera. —"B.J.," Nov. 29, 1912, p. 923.



Fitting Prism to Finder.—W. H. Blacar advises the fitting to the ordinary brilliant finder of a prism of angle of about 15 deg., and costing about one shilling. Placed as shown in the drawing, the prism allows of the finder being viewed at an angle of about 55 deg. instead of in the often awkward position of vertically downwards. —"Photo-Era," Feb., 1913, p. 91.

A Pocket Tripod.—"A. A. L." describes the construction of a portable support for the camera, consisting of a walking-stick with handle, which latter is clamped to the under side of a triangular board forming the "tripod" head. To the corners of the board lengths of stout twine are attached by screw eyes, the lower end of each being fixed in the ground by means of a skewer or peg. The lengths of twine being spread out like the legs of the ordinary tripod, the whole forms a fairly rigid support for a small camera, and the device is one which provides a tripod for the pedestrian from his walking-stick *plus* the board, twine, and pegs, which can be readily carried in the pocket.—"A. P.," Dec. 23, 1912, p. 640.

Artificial Light.

Cold Light.—L. B. W. Jolley describes the method of M. Dussaud of obtaining intensity and efficiency from electric incandescent filament lamps by frequent interruption of the current, it being possible to over-run a lamp by as much as 200 per cent. without the filament fusing. The light produced on this system may be obtained of very great intensity and with great economy in the consumption of current. While the filament is actually much hotter than in continuously run lamps, the bulbs keep quite cool, since the heat is dissipated by the revolution of the interrupting disc. The system has been applied to lamps for projection and other purposes.—"B.J.," April 11, 1913, p. 286.

Flash Powder.—Messrs. Schering have described an improvement in the making of a magnesium flash powder from a mixture of magnesium and cadmium nitrate. Such mixture of itself is liable to spontaneous explosion (B.J.A., 1908, p. 599), which latter may be avoided by addition of magnesia or magnesium carbonate. For example, a suitable mixture for a flash powder consists of 50 parts magnesium, 44 parts dried cadmium nitrate, and 6 parts magnesia. When this mixture is brought in contact with a few drops of water and stirred up, a slight development of heat takes place, but in no circumstances sufficient to give rise to ignition of the powder. The powder is described as being highly actinic, rapid in combustion, and producing very little smoke. The grade of magnesium powder to be used is "F.90." The magnesium may be replaced in part by aluminium powder.—Ger. Pat. No. 254,407, of Nov. 4, 1910; "B.J.," Feb. 14, 1913, p. 129.

How to Burn Magnesium Ribbon.—The ribbon must be perfectly bright and free from oxidation, this condition being readily obtained by passing the metal strip once or twice between a fold of fine sandpaper held by the thumb and finger. In the next place, the metal should never be burned in a single strand: three or four strands should be loosely plaited together and secured at every two or three inches with a turn of fine flower wire. Then if one strand goes out the others will re-light it. The exposure is also shortened, and thereby finished before any smoke has had time to drift into the field; four strands each 6 ins. long will burn in less time than one strand 2 ft. long, and yet give the same exposure. Thirdly,

one should provide a good pair of pliers or a small hand vice for holding the ribbon while burning and a piece of old carpet to catch the hot ash. If the carpet is of fair size it permits of the ribbon being turned about during combustion. This prevents the sharp shadows so often seen in flashlight pictures. If much work has to be done, a sort of tin Dutch oven may be used, with a fixed clip for the ribbon and a tray for the ash, the back serving as a reflector and protecting the operator's eyes.—"B.J.," Nov. 8, 1912, p. 8

Flashlight Electric Ignition.—H. E. Coston and the Dover Street Studios, Limited, have patented an appliance for the simultaneous ignition of a number of charges of flash-powder. It consists in the use for this purpose of a high-tension electric current, which is caused to spark across a number of gaps arranged in series to effect the several ignitions. The gaps and the distribution of powder in their vicinity are similar so as to obtain practically equal rates of combustion of each of the portions of powder.—Eng. Pat. No. 23,016, 1911; "B.J.," Dec. 20, 1912, p. 981.

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

Portraiture.

Portraiture with Enclosed Arc.—G. F. Greenfield has described his own design of using enclosed arcs by reflection for studio portraiture. The arrangement is recommended as giving softness and roundness of lighting, and is suitable for both vigorous and flat lighting; in fact, almost any "daylight" lighting.

The principal points of the complete apparatus are readily seen by reference to Fig. 1. The whole of the light used is reflected from a curved white surface of not too large an area. The middle of the reflector being nearer to the arcs than are the sides, the strongest light proceeds from a smaller central area, giving crispness to the high-lights.* Further, the lamp, instead of being hung from a fixed point, is placed on a stand which may be readily wheeled to any part of the studio, thus making the placing of the light-source even easier than with daylight. Finally, the metallic reflectors which cut off the direct light are of just such a size that, whilst shielding an ample area for groups, they permit beams of direct light to proceed from each side. This gives the reflector on the shadow side of the sitter sufficient illumination to be really effective, especially as it lights up more strongly that part of it which is to the front of the sitter. Fig. 2 will make the working of this quite clear.

To descend to details. The stand is strongly built of oak, somewhat after the fashion of a camera stand. Care should be taken that the legs have sufficient spread to prevent any possibility of the whole being overturned in use, also that the castors which are fitted work easily and smoothly. The large rubber-tyred castors supplied specially for studio use are the best. The central pillar is

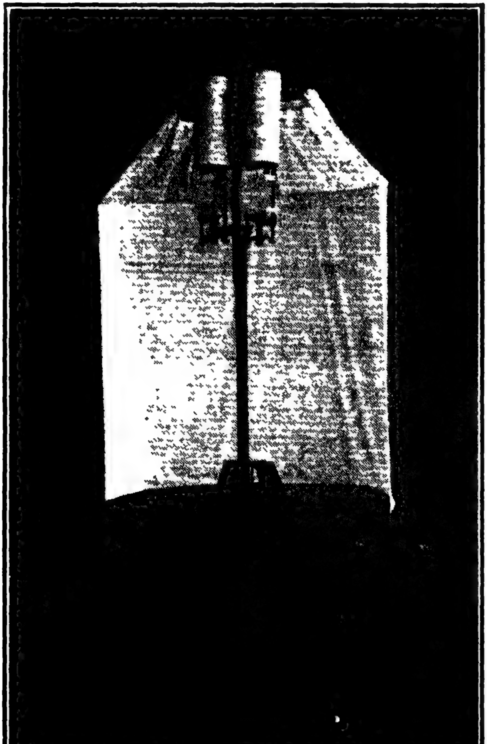


Fig. 1.

of 2-in. oak, and is raised and lowered by means of a rack and pinion (not seen in the photograph), the handle being secured by a ratchet. This pillar must be of such a height that the flame of the arc can be raised to 8 ft. from the floor, and it should be possible to lower the lamp to 5 ft. when necessary.

In the stand illustrated the two lamps are secured to an easily detachable top portion of the pillar, enabling them to be used in other positions if required, such as for enlarging, firelight pictures, printing, etc. Fig. 3 shows on a larger scale the detached top carrying the lamps.

The current is best conveyed by a stout, flexible cord laid on the floor, and the connection made by a wall-plug. Care must be taken that the "flex." is sufficiently thick to carry the necessary amperage, or trouble will probably ensue. Also, the plug should be so marked that, in making the connection, it is easily ensured

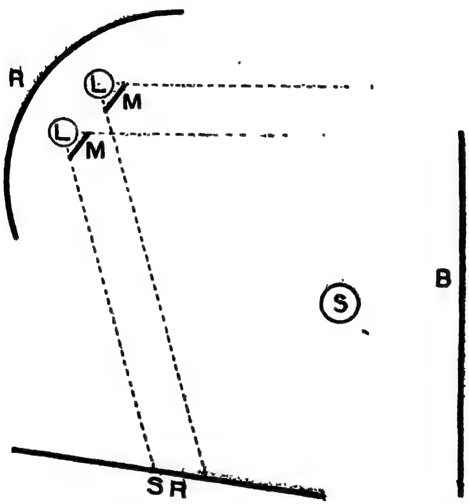


Fig. 2.

B. Background. S. Sitter. L, L. Lamps. M, M. Metallic Screens.
R. Reflector SR. Shadow-Side Reflector.

The dotted lines show the limit of the direct rays.

that the top carbons are always positive. The resistance, if safely covered from the prying fingers of children, may with advantage help to weight the lower part of the stand.

The reflector when in position measures some 4 ft. 6 ins. from side to side, and consists of a piece of the closest and whitest "longcloth" obtainable, measuring (flat) about 6 ft. square. It is supported in position by a framework of ¼ in. wire (see Fig. 4), which rests by its own weight in grooves cut to fit in its wooden support. The reflector hangs from the top portion of this framework by small brass rings, rendering it readily removable for washing purposes.

It will be noticed that the arcs are placed at the top of the reflector, this being correct for continuous current. If the supply be alternating, as much light will be thrown up as down, and the position of the lamps would require modifying accordingly.

Such a lamp occupies very little room in the studio, and can be

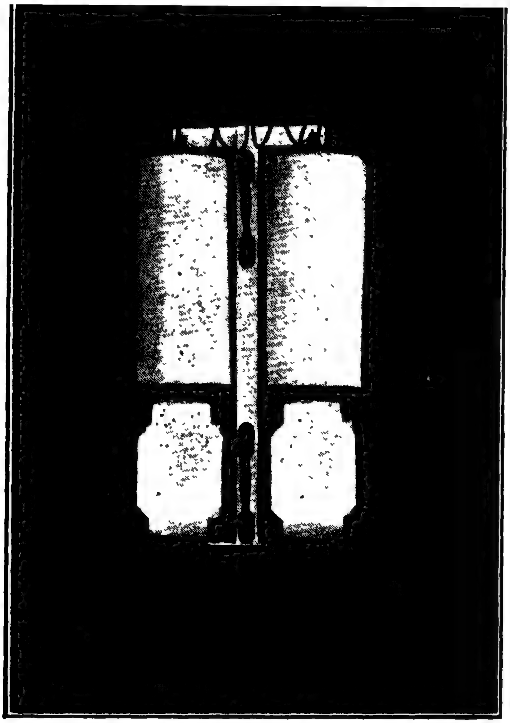


Fig. 3.

Detached tops carrying the lamps.

pushed away in a corner when not required. It is complete in itself, ready for use at a moment's notice, and abolishes completely all need for clumsy reflecting and screening arrangements. Further, with its ready mobility, it can at any time be used to supplement the weak winter daylight. Finally, the cost of the complete stand

with reflector need not exceed 15s.—the "flex." and wall-plug vary considerably in price, according to the amperage required. In any case, the cost is small enough to justify any dissatisfied possessor

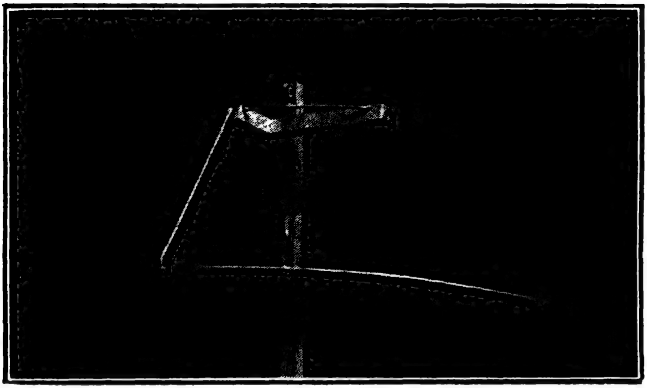


Fig. 4.
Framework for reflector.

of an enclosed arc in giving the system a trial. Even the satisfied possessor may find it worth his while.—"B.J.," Jan. 31, 1913, p. 79.

Enlarged Prints on Wood Cut to Outline.—G. C. Bradbury has given working instructions for the making of outline portrait photographs mounted on wood, after the manner of some French cartoons.

Fig. 1 gives a general idea of the finished article. A suitably posed full-length figure is printed on fairly thin paper in any desired process. Smooth matt bromide paper gives as suitable a print as any, and the convenience of bromide is realised when making the figures larger than the original negatives. Photographs taken on half-plates practically all require slight enlargement, or the figure looks too diminutive. Black and white prints also look considerably better than sepia, but quite possibly warmer prints would suit some workers. The size of figure also leaves much to the individual taste, but a useful size stands 8 ins. high without the base. The tools and materials required are few and very inexpensive. One requires, first, some sheets of thin wood known as "three-ply." It is obtainable from most ironmongers who supply fretwork materials, and is stocked by almost any dealer in wood, even in small towns. It is obtainable in several thicknesses, but for the best effect with figures of 8 ins. or less in height the wood should not exceed $\frac{1}{8}$ in. to 5/32 in. in thickness, and for quite small figures a bare $\frac{1}{8}$ in. is sufficient.

The wood is first smoothed with fine emery cloth or sand-paper, and the photograph, backed with a double thickness of "Simplex" dry-mounting tissue, will adhere perfectly at about 140° with moderate pressure. The photographer who does not possess a suitable dry-mounting press can probably carefully mount the print wet with a strong press and make a satisfactory job, but, naturally, the dry method is to be preferred.

The tools next required are a fret-saw frame and a few fine saws—*e.g.*, "Hobbies" or "Star" saws. The figure is cut down, keeping as closely as possible to the natural outline, but parts of the dress or figure can be cut away to suit the artist. Particular care should be exercised if the facial outline has to be followed, for likeness can quickly be lost by a very small slip of the saw. For this reason, figures with hats or those taken in a full-face position are most suitable. Besides following the general outline,

FIG. 1.

all background should be cut away where it shows under arms or between feet, and the fret-saw can then be abandoned in favour of a sharp pen-knife and a piece of emery cloth.

The square saw-cut is carefully rounded with the pen-knife and smoothed with the sandpaper. Below the feet of the figure "dowels," or tabs of wood, should be left for insertion in the baseboard. These tabs should be about ½ in. each in width; if the figure is wide, several at intervals of about an inch may be required. A block of wood about ¼ in. to ½ in. in thickness is cut out for the plinth (thickness according to size of figure), and slots are cut with the fret-saw, into which the tabs below the feet of the figure fit tightly. This oak, after sand-papering, can be either fumed dark or given a coat or two of cycle enamel to suit the individual fancy. Either looks quite equally well.

Next the somewhat shabby-looking wooden back requires painting and finishing. A small tin of white enamel is purchased from the nearest ironmonger or oilshop and a stone bottle of "Bates'

Photographic Dead Black" from the photo-material dealer. A small quantity of white enamel is placed on a palette, or any piece of flat wood or glass, and a minute amount of "Photo Black" added to one end of the white patch of paint. With these simple materials a colour to match the various parts of the figure is easily compounded.

The edge of the wood should be matched in colour as neatly as possible to the adjacent edge of the photograph, and the plain wood at the back can then be given an even coat of paint or roughly painted in black, white, and greys to represent the rear view of the person photographed.

Fig. 2.

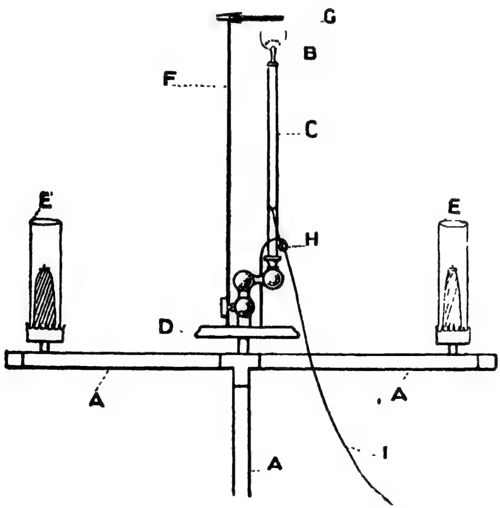
Although not essential, this variegated colouring of the back is a great improvement, and gives a much more finished look than a plain colour, and should the figure chance to be placed before a mirror the advantage of the slight expenditure of time and labour is at once evident (Fig. 2).

The models look well when made from almost any full-length photographs, but the style is particularly suitable for photographs of children, and these are, naturally, the best sellers. If several different figures are ordered by one customer it is advisable to take care that they are all to scale, for a 6 ft. father cut out 8 ins. high and a child made the same height spoil the effect, and, in fact, make both figures look ridiculous.—"B.J.," Oct. 10, 1913, p. 776.

FLASHLIGHT.

Judging the Lighting Effect Before Exposure.—W. H. Cooper advises placing as strong a source of light as is available in the position which the flash will occupy, extinguishing other lights in the room. Usually this pilot light is not sufficiently strong to allow of the image being seen on the ground glass, in which case the lens may be unscrewed, the ground glass turned back out of the way, and then, putting the camera with the lens turned away from the sitter, we can look through the opening left by the lens direct at the subject itself, seeing it framed, as it were, by the opening in which the ground glass goes. When the arrangements have been made in this way, the lens and ground glass may be replaced, the camera turned round, and the focussing itself done with the help of any other lights that there may be in the room, which, when once the lighting effect has been studied and settled, may be relit and left burning.—"Phot.," Dec. 24, 1912, p. 518.

Flashlight Portraiture.—T. Stennett uses for igniting flash powder a small gas flame supplied from a burner on a bracket which can be pulled down on to the flash powder. The rough sketch will explain matters:—A, gas tubes; B, burner; C, ordinary movable wall bracket; D, screw plate; E, incandescent lights for focussing;



F, rod screwed in plate D with spring clip on top to hold G; G, tray for powder; H, bent rod to act as stop and guide cord; I, cord as long as necessary.

To commence operations, the gas bracket is pushed back out

of the way and lighted. Then the amount of powder is placed on a small piece of tissue paper and placed on tray. Obviously, when the cord is pulled it will pull the lighted burner under powder, and H will prevent bracket coming too far.—"B.J.," March 14, 1913, p. 219.

Firelight and Other Effects by Artificial Lighting.—G. R. Henderson describes arrangements for the use of an arc lamp in producing firelight and other strong effects of lighting. A cabinet is made for the arc lamp on the lines of Fig. 1. Fig. 2 shows how this cabinet is placed in reference to the sitter and to the fireplace studio accessory, behind which a second arc lamp is used. This supplies the main lighting, and should be arranged so that it can be lowered almost to the floor or drawn up to the ceiling out of the way. The

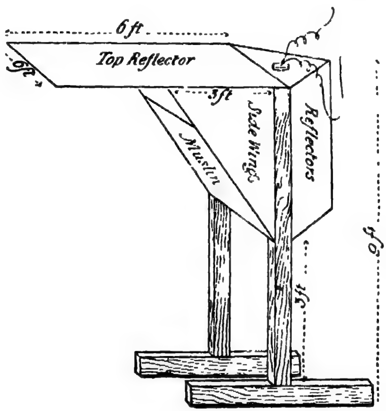


Fig. 1.

opening in the fireplace through which the light must come should begin about 4 ins. from the floor and extend to within 18 ins. from the floor. The light will then be low enough to avoid glare in the eyes of the sitter. A few thicknesses of nainsook should be placed across the opening, so that the light can be modified to any degree necessary. If a few pieces of coal be placed in the grate the light behind will show through the interstices and give a live-fire effect that greatly enhances the final result, and will also minimise retouching. With this arrangement and the proper use of the light from the cabinet, exquisite effects should be obtained, and once the correct balance is found the same exposure and further procedure will give exactly similar results.

The negatives require to be thin and full of detail. A very suitable developer is the following pyro-metol formula :—

No. 1.

Pyro	65 grs.
Metol	55 grs.
Soda sulphite	2 ozs.
Potass. metabisulphite	25 grs.
Potass. bromide	10 grs.
Water (to)	20 ozs.

No. 2.

Soda carbonate	2 ozs.
Water (to)	20 ozs.

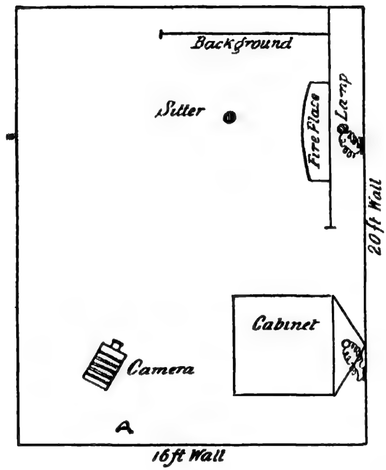


Fig. 2.

For use take 1 oz. of each and dilute to 5 ozs. with water. This formula will be found exceedingly useful for all classes of artificial lighting. Care must be taken in developing exposures and over-development avoided at all costs. The camera and lens must be screened from the light as much as possible, else fogging and halation are almost bound to occur.

As regards exposures, these, with extra rapid portrait plates and lens at $f/4{\cdot}5$, should run to about $1\frac{1}{2}$ seconds.—"B.J.," Dec. 13, 1912, p. 952.

Copying.

Photographing Pictures.—D. H. Watson, in the course of a lengthy article on this subject, deals with the difficulties of procuring lighting of the picture such that the latter does not show reflections. He points out that in placing camera and picture regard must be paid to the fact that when a ray of light strikes a flat reflecting

surface, as AB in Fig. 1, the angle of reflection, ACE, is equal to the angle of incidence, BCD.

Thus an observer anywhere along the line CE would see a reflection of the light coming from D. • It also follows that anyone looking along CE towards C can only see the reflection of the light coming from D. From this we realise that if we put up a picture and find one part of it covered with reflection, the reason is that the light which is falling upon that part is being reflected into our eyes, and it is, therefore, necessary either to cut off the light which is reflecting or else to turn the picture at such an angle to it that it no longer comes within the reflected area. Thus, in Fig 2, if CD is a picture lighted by the window YZ, and A is about the point from which we must photograph it, then it will be found that the portion between G and C will reflect light, and that no detail in that part is visible. If the portion of the window between Z and X be curtained off, the reflection will disappear, because, as the diagram shows, it is only between X and Z that any light can

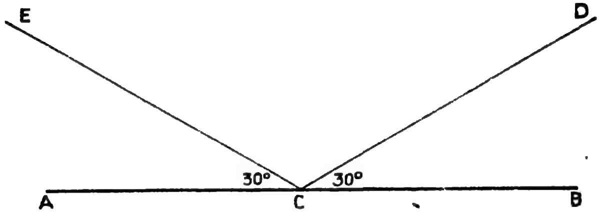


Fig. 1.

come which will reflect to A. Instead of cutting off part of the window the picture could be turned round to position shown by dotted lines CD', and again the reflection will be avoided, for no light entering between Y and Z can reflect from the picture to A', the new position of the camera. It must be remembered, however, that, in addition to avoiding reflection from the canvas, it is also necessary to have the light evenly distributed over the painting, or else one part of it will photograph lighter than the rest. This can be most easily arranged by having the picture some distance from the window (say, seven to ten feet), and at an angle of about 75 deg. to it. The more nearly at right angles the picture is to the window the further from it it must be in order to avoid any great difference between the light which reaches the one side and the other.

In connection with the lighting of a picture there is another factor which has a great deal to do with the ultimate result, and that is the focal length of the lens. The longer the focus of the lens the easier it is to get the picture evenly lighted and quite free from reflection. The reason for this is easily seen if Fig. 3 is examined. CD is the picture, which is placed at an angle of 75 deg. to the side of the room of which EF is the window. O is the centre of

the picture, and OX is a line perpendicular to the picture, so that the lens must occupy some point on OX. If we use a short focus lens, then the camera will be somewhere about A in order to get the image the desired size. Now we have seen that if light comes through the window as shown by the dotted line GC, it will just be reflected from the edge of the picture into the lens at A, and, therefore, we must draw the curtain to G in order to avoid reflection. If, however, a lens is chosen which allows the camera to go back to B, then H will be the first point in the window which will reflect, as shown by the lines HC-CB. Thus it is only necessary to stop out the portion between F and H to avoid all reflection. Thus we have gained all the light between G and H, and not only greatly increased the quantity of light, but also got it more evenly distributed over the picture.

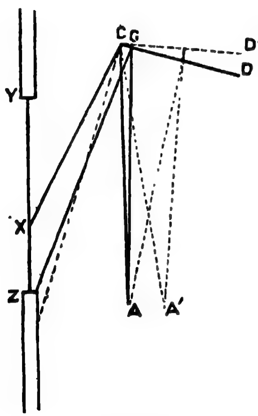


Fig. 2.

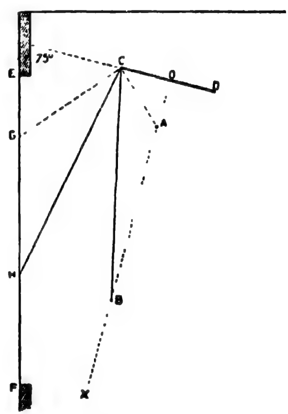


Fig. 3.

In addition to having the source of light outside the area of reflection, it is also necessary to remove any light objects which could be reflected by the canvas. The picture to be photographed must be regarded for the time being as a mirror, and everything behind the camera removed that could possibly be reflected. If the picture is a dark one, any reflecting objects will be quickly visible, but there are often slight reflections which might easily be overlooked at the time of photographing, but which would spoil the ultimate result if not removed. Of course, a light picture does not require anything like the amount of care necessary to light a dark picture, but it is well to remove any object of a specially bright nature behind the camera.

If the photographer clearly understands the cause of this troublesome reflection he will easily recognise the best way to avoid it in different circumstances.

When working in the studio the matter is fairly easy, as there are blinds to control the light. Place the picture at a slight angle (about 75 degrees, as shown in Fig. 3) and arrange the blinds so that there is an even light over the picture, and roughly focus the camera to the size required. Then place the eye just in front of the lens and you will at once see if there is any reflection. If there is reflection on the left side, that means that the light on the left extends too far back, and it is necessary to draw forward the curtains. If the reflection is at top left corner, that shows that the top light is a little too low at the left side. If the reflection is all along the top, then it is necessary to close the blinds furthest from the picture. There is generally no difficulty in getting rid of reflections; the chief care is to see that the light is kept at the same time evenly distributed over the picture, and it is often necessary to cut off light which is *not* causing reflection in order to keep the whole surface evenly lighted, and that is why the long focus lens, which allows the use of such distributed light, is so great a help in photographing pictures.

All light which is not being used to light the picture should be cut off, as it minimises the risk of accidental reflections, and also avoids any stray light getting into the lens.

When a picture has to be photographed in a private house the difficulties increase very greatly, for here there is little or no control over the light, and the arrangement has generally to be made by moving the picture until a satisfactory lighting is obtained. Generally, it is only possible to make use of one window in the room, and unless more than one window really illuminates the canvas it is far better to close all the others, as they will only be a source of annoyance and will do no good. The picture should be placed at an angle of about 75 degrees to the wall in which the window is, and far enough away for the light to fall evenly upon it. If the camera is then got roughly into position it will be seen if there is no reflection. If there is it will generally be got rid of by turning the picture a little more away from the light. When photographing in a room, if the picture is an upright one, it should be photographed in that position, but if an oblong, it is easier to get it well lighted if placed in an upright position, taking care that the top of the picture is the side next to the window. When photographing at a private house, especially in the country, it is often easier to photograph the picture outside, but the points to be observed are just the same. If direct sunshine can be used there is very seldom any difficulty, as the strength of the sunlight is so much greater than the other light that there is little trouble with reflection. If sunlight is not available, more care is necessary; but if the above principles are understood there should be no great difficulty. If the picture can be placed so that it faces some dark object, such as a shrubbery or a dark house wall, or, in fact, in any position where the light that falls on it is much stronger than the light it reflects, all will be well, as outside there is practically no trouble in getting the light even.—"B.J.," April 25, 1913, p. 319.

Focussing Scale for Copying.—Henry W. Bennett has described the making and use of a scale for expediting copying work by indicating the extension of the camera and the distance of the lens from the original when copying a subject upon a given scale with a lens of given focal length.

In order to construct the scale, the camera should be set up with the front and back parallel, and the lens, which it is intended to use for copying, in position. A distant object should be accurately focussed on the ground-glass, an object three or four hundred feet away, if possible, so that it practically corresponds to infinity. A flat piece of wood, about an inch broad and an eighth of an inch thick, and as long as the fullest extension of the camera, will be required for forming the scale. It should be held against the camera when the distant object is focussed, and a mark should be made to record accurately the distance between the back frame of the camera and either the edge or some well-defined line on the front frame. Diagram 1 will illustrate this. It is not important which part of the front frame is selected for the point to correspond to the mark on

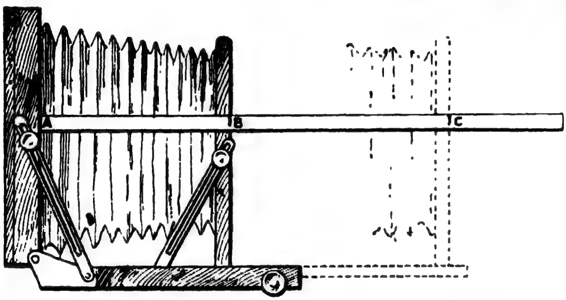


FIG. 1.

the focussing scale, excepting that it should be a point which can always be readily seen against the scale at all extensions of the camera.

After the distance between the two points has been marked on the scale when the camera is focussed for infinity, the camera should be placed in front of a line engraving or some similar subject—one containing fine and sharply defined lines—and a perfectly sharp image obtained on the focussing screen exactly the same size as the original. An engraving or page of type almost as large as the focussing screen should be chosen, so that the risk of error in determining when the image corresponds in size with the original may be as small as possible.

The flat piece of wood intended for the scale should again be applied to the camera, and the distance between the two points—the front and back frames—again marked on the scale, as illustrated by dotted lines in Fig. 1, A indicating the end of the scale that touches the back frame, B the mark corresponding to the selected point on the camera front when focussed for infinity, and C the

mark indicating the position of the same point when the camera is extended for producing an image the same size as the original.

The work with the camera is now finished, and the completion of the scale will only require a few minutes. Its appearance at this stage is shown in Fig. 2, the reference letters corresponding to those in Fig. 1.

The distance between the two points B and C on the scale must be divided into a convenient number of equal parts; sixteen, if the photographer prefers to work in ordinary fractions; twenty, if he prefers decimals. The divisions should be continued beyond point C as far as the length of the scale, or the camera extension, will permit.

The appearance of the finished scale is shown in Figs. 3 and 4; Fig. 3 showing the common fractions, Fig. 4 the decimal division. Intermediate divisions may be added, if desired.

In practice, the use of this scale is exceedingly simple. For example, it is required to photograph a drawing or a print 10 inches long, the resulting copy to be 6 inches long. The scale is

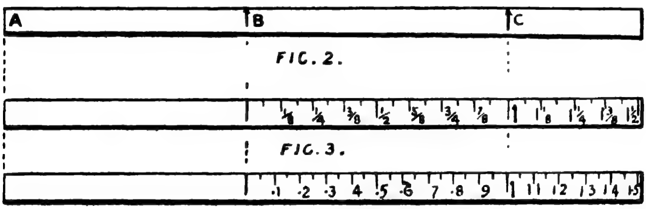


FIG 4.

applied to the side of the camera, as in Fig. 1, but the camera is racked out until the point on the front is exactly against the point marked ·6 on the scale, Fig. 4. The camera is now moved on its guides to or from the easel containing the drawing until the image is quite sharp on the focussing screen. When it is perfectly sharp it will be the exact size required.

An example in ordinary fractions may be useful. A print or photograph, 8 inches high, has to be copied and reduced to 5 inches. The camera is extended until the distance between the points shown in Fig. 1 corresponds to the line marked $\frac{5}{8}$ on the scale shown in Fig. 3, when the scale is applied to the camera as in Fig. 1. Focussing is carried out by sliding the camera towards or from the original, as in the preceding example, and when the image is sharply defined it will be the desired size.

Focussing must not be modified or finished by racking the camera front in or out. The extension of the camera, when once determined by the scale, must not on any account be changed, or the size of the image will not be correct.

Focussing an image and securing the exact size required by the use of this scale will be the work of a few seconds only; the operation is so exceedingly simple.—"B.J.," July 18, 1913, p. 556.

Adjusting Original on Copyboard.—R. Merrett gives the following hint for saving time in placing an original to be copied upon the easel when it is required to come in the centre of the plate. Instead of pinning up the original haphazard and then adjusting the camera to the position of the print, which is the method adopted by most photographers, just put in a small stop and place the photograph so that it is reflected in the centre of the stop. It will then be found to be in position on the screen. This method will save time.—"B.J.," May 23, 1913, p. 405.

Osram Lamps for Copying.—A. Mann recommends the Osram metallic-filament lamps for commercial copying work as an improvement on arc lamps. Four 55-watt lamps, placed at about 12 ins. distant from the copyboard, are arranged to come at the corners of an 18-in. square, and thus give perfect illumination of originals up to about 9 × 7 in. size; for larger originals the lamps should be further away from the copyboard, and six or eight might be used with advantage.

The exposure for black and white diagrams on process plates, using a stop of *f*/44 actual value (*f*/22 nominal) copying full-size, is 2½ min.; with an "ordinary" plate copying, say, a P.O.P. print full-size, 3 to 4 min. Therefore, when copying full-size with *f*/8 the exposure would be under a minute, which is quite reasonable.—"B.J.," Nov. 8, 1912, p. 870.

W. T. Wilkinson writes that when copying same size with the original illuminated by two enclosed arc lamps, 10 amperes each, eight feet away from copy, using ordinary plates, 80 H. and D., required an exposure at *f*/64 actual, of three to eight seconds, no constant time being possible on account of the inevitable jumping of carbons inseparable from automatic feed.

Using plates 26 × 21 and larger for rotary photogravure, this short and uncertain exposure, coupled with excessive granularity of shadows (although the light was filtered through tissue paper), rendered a change of illumination imperative, so a large frame was made, 42 × 36 ins., opening 36 × 28. Round this frame twelve Osram lamps, each 100 candle power, were fixed, wired, in parallel, and connected to main supply at 210 volts. This frame, placed three feet away from copy, gave a beautifully even illumination, and, using same plates, aperture *f*/32 (actual), the exposure was thirty seconds, and the negatives perfectly free from granularity.

This result was eminently satisfactory, as also the £ s. d. side, the two arc lamps taking at least 20 amperes, whilst the twelve Osrams only take six amperes, and give the better negatives.—"B.J.," Nov. 15, 1912, p. 889.

Survey Copying Camera.—In a publication from the Government Printing Bureau, Ottawa, Dr. E. Deville, Surveyor-General of Dominion Lands, has described in detail the survey camera employed in his department for the rapid and accurate copying to scale of plans, etc. The paper also contains a detailed and very clear exposition of the geometrical principles of the copying camera and their application in practice. Dr. Deville also deals with the methods of illuminating originals by artificial light, and adds a

table of factors for computing the graduation of a copying or enlarging camera as well as the necessary comparative exposures.—"B.J.," Dec. 13, p. 955; Dec. 20, p. 973, and Dec. 27, p. 993, 1912.

TELEPHOTO WORK.

Simplified Exposure in Telephoto Work.—Capt. Owen Wheeler has worked out a system of arriving at the exposure in telephotography, when employing a wide range of magnifications, without resorting to arithmetical calculations beyond the simplest. One starts with the assumption that one is going to stop the positive down to *f*/16. In ninety-nine cases out of a hundred it is desirable to do that, even with the very best combination, if really good definition all over the plate and a fair amount of depth of focus are required. We then take the light with an ordinary meter, making due allowance for distance and character of subject, but reckoning the aperture as, not *f*/16, but *f*/64. Finally, we use the following multiples for the magnifications noted :—

For	4 magnifications	×	1
	5 ,,	×	1½
	6 ,,	×	2
	7 ,,	×	3
	8 ,,	×	4
	9 ,,	×	5
	10 ,,	×	6
	11 ,,	×	7
	12 ,,	×	8
	13 ,,	×	10
	14 ,,	×	12

This generally takes about a quarter of the time one would spend on the old rule of multiplying the ordinary exposure by the square of the magnifications. The results are very near to those by the old rule :—

Magnifications.	Old rule.	New rule.
4	1 sec.	1 sec.
5	$1\frac{9}{16}$,,	1½ ,,
6	2¼ ,,	2 ,,
7	$3\frac{1}{16}$,,	3 ,,
8	4 ,,	4 ,,
9	$5\frac{1}{16}$,,	5 ,,
10	6¼ ,,	6 ,,
11	$7\frac{9}{16}$,,	7 ,,
12	8 ,,	8 ,,
13	$10\frac{9}{16}$,,	10 ,,
14	12¼ ,,	12 ,,

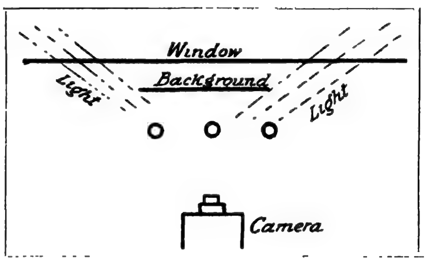
In practice the divergence in the case of the exposure at 11 and 13 magnifications matters very little, but an allowance can, of course, be easily made in these cases.

If the tele-positive is stopped to *f*/11 or *f*/8, the exposure on which the method is based must be taken as for *f*/45 or *f*/32, as the case may be

The method does not modify in any way the common-sense precautions which have always to be taken in regard to tele-photography of distant objects, more especially in the matter of the alteration in character which objects sometimes undergo when brought visually nearer to the camera. It cannot be too strongly urged on the novice in this branch that he must make due allowance for a subject which, if taken with an ordinary lens, is merely part of an open landscape, but when telephotographed may become a building with a dark foreground. It is always necessary to make such allowances, as well as that for the ortho screen, if used, before applying the magnification multiples.—"B.J.," April 11, 1913, p. 287.

MISCELLANEOUS SUBJECTS.

Photographing Glassware.—F. T. Beeson has described the method which he finds most effective in making photographs of cut glass, etc. It is to place the glass articles so that light falls upon

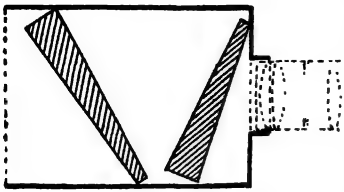


them sideways from a source somewhat behind them. The diagram shows a convenient means of securing this lighting. The background is placed close against the window, the articles a short distance in front of the ground, and the camera facing the window.—"B.J.," May 23, 1913, p. 403.

Theatre Snapshots.—A. Lyles describes his success in colour-sensitising Ilford "Zenith" plates for shutter exposures on subjects in a theatre by the ordinary lighting. The plates were bathed in pinacyanol. Two parts of the 1:1,000 solution of the dye were mixed with 100 parts water and filtered immediately before use. The plates were bathed for three minutes, washed for three minutes, and then dried quickly. With a lens of aperture $f/7{\cdot}7$ exposures were about one second, development being done in weak metol-hydroquinone.—"Phot. Scraps," Aug., 1913, p. 156; "B.J.," Aug. 8, 1913, p. 612.

Distorted Photographs.—A method of making distorted photographs, which is cheaper than the use of a large distorting mirror, is the following:—A glass beveller will supply cheaply enough two or three prisms, which should be decidedly larger than the lens of

the camera; 2× 2 ins. is a convenient size for lenses up to half-plate, which prisms should have their two flat surfaces inclined towards each other at an angle of about 20 deg. A little fitting of cardboard must be made to carry these prisms in front of the lens in the way shown in the attached sketch. It should be provided with a collar fitting on the hood of the lens, so that the whole affair can be turned round the lens so as to vary the effects.



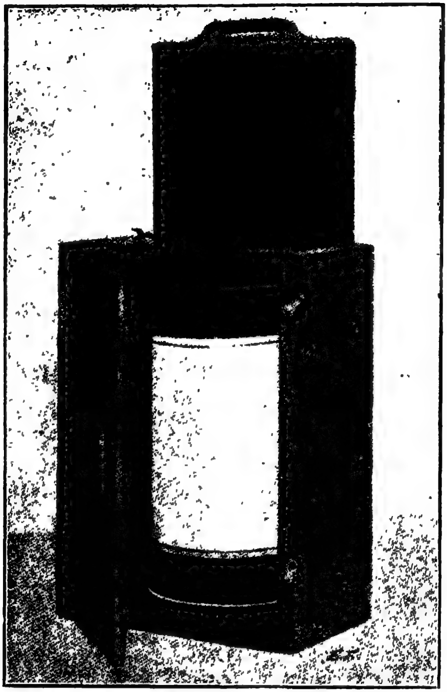
The edges of the prisms and the whole of the interior of the fitting must be very carefully coated with a dead black varnish, or it will not be found possible to get good bright negatives on account of the internal reflections; but with adequate blacking and a little care in the selection of subjects this difficulty can be overcome. When such an arrangement is attached to the lens the image will be most curiously distorted.—"Phot.," Sept. 23, 1913.

Enlarged Copies Direct of Small Convex Objects.—Dr. E. Stockis uses the following method in making enlarged reproductions direct in the camera of subjects such as finger prints on bottles and other curved surfaces, markings on bullets, etc. :—The image is formed not upon a flat focussing screen, but upon one (of film) suitably curved. When copying same size the curve of the focussing screen is arranged equal to that of the object; when enlarging, the curvature is in proportion to the scale of enlargement. Thus, for an object of 5 mm. radius, which is enlarged ten times in the camera, the film, for focussing and for making the exposure, should have a concave curvature of 5 cm. radius.

In practice the arrangement is as follows :—The ordinary dark-slide is replaced by a much deeper exposing chamber—a box. This is closed in front by a sliding shutter, and at the back by a hinged door. In this deep dark-slide is placed a semi-cylindrical block of wood, flat side towards the shutter; a large aperture is cut to the greater part of its height. The block is made of given curvature (radius in cm.), and a number of similar pieces of apparatus of different curvatures are constructed for use in the dark slide. Similarly, in the case of negatives required of width, other blocks of the same kind are made, but with the horizontal curvature along their length. For focussing, a film is placed over the block, the surface being rendered matt by fogging, development and bleaching with mercury chloride. The film is attached very simply to the block, gelatine surface of the concave side towards the shutter of the dark-slide. The whole apparatus is fixed in the dark-slide, which is specially made for fitting to the back of the camera, and the object is then focussed. The distance of the object, as also the extension of the camera, are decided upon in advance, as in all operations of photography for measurement purposes. The centre portion of the image is focussed, and the whole visible part

of the convex-surfaced object is thus formed to right and left of the centre of the film with perfect sharpness.

Focus having been obtained, the slide is removed to the dark-room, and there the matt film replaced by one of ordinary sensitive-

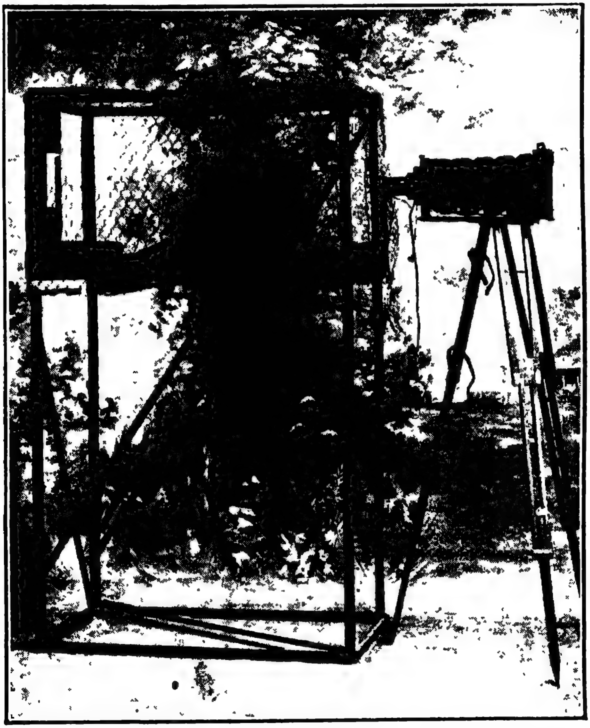


ness, the block being replaced, as before, in the dark-slide, and exposure made. There is thus obtained a negative all the detail in which throughout the image is perfectly sharp.—"B.J." (from "Archives Internationale de Medicine Legale"), Aug. 15, 1913, p. 626.

Pigeon Photography.—A. E. Ashley has described a form of cage, or "studio," specially designed for the purpose of facilitating the photography of pigeons. The cage causes the pigeon to take a position at a fixed distance from the camera, whilst means are provided for quickly placing the pigeon in, and withdrawing it from, the cage.

The dimensions of the cage will vary with the focal length of the lens, but for a fairly long-focus lens, say, 15-inch or a 3B (either

used on a half-plate), the measurements should be about 3 ft. 6 ins. long × 1 ft. 9 ins. square, with a perch (which may be made to imitate the top of a wall) at the "sitter's" end, raised about 4 ins. from the bottom, and not more than 3 ins. broad, so that the bird can only find a comfortable position by standing sideways—the way we want it to stand. This perch should be the only comfortable rest for its feet in the place, and this can be brought



about by "paving" the bottom with a coarse wire netting, the same as is used for the sides and top.

The background end is made of three-ply wood, with a door just large enough to put the bird through and get the arm through to take it out, say 7 ins. square. Before fastening on this end, place a piece of grooved matchboard at the top and bottom, with the grooves towards each other, and have light and dark pieces of cardboard cut to fit so that they will slide in the grooves. They

can then be caused to slide in and out while the bird is on the perch, and any desired tone of background obtained.

To facilitate getting the bird out, and also to keep it still until it gets used to its new surroundings, if this should be necessary, fit a swing wire screen which can be swung up and down by means of the extended sides outside the cage. It is hinged to the bottom of the perch, and lies on the bottom of the cage until wanted, when it is quietly swung up, and holds the bird helplessly in a trap the width of the perch, when the bird can easily be got hold of through the door in the end.

The other end is fitted with string netting with a hole cut in the centre for the lens-hood to go through and tied round by interlacing a piece of string through the meshes. This netting is larger than the end, and is held to the cage by hooks, so that it can be let out to lengthen the cage if necessary.

A "posing stick" is used to pose the birds with. By its aid we can straighten a ruffled feather, lift a drooping wing from below the tail, press their tails down, lift their heads up, turn them more sideways to the camera, and perform other movements; but the fingers must be kept on the shutter release all the time, and immediately the bird is standing nicely off the shutter must go without the least delay.

It will be obvious from the functions it has to perform that the posing stick must be somewhat smaller than a broom shaft. A halfpenny cane is as convenient and handy as anything. Although it is generally a most useful tool, there are times when it is useless, and other devices have to be resorted to, such as letting everything be quite still for a while and then making a very slight noise. In extreme cases, when the bird is very shy or has got upset by other methods, it is found that a successful plan is getting someone to stand behind the cage while one gets out of sight behind the camera, and both keeping quite still until it has settled down, when the person behind very gently scratches on the back of the cage so that the bird cannot see what causes the noise.—"B.J.," Jan. 3, 1913, p. 5.

IV.—NEGATIVE PROCESS.

WET COLLODION.

Structure of Wet Plate Negatives.—F. C. Frary and G. H. Woolett find that the chief grain in wet plate negatives depends wholly on the concentrations of the ferrous sulphate and the silver nitrate in the developer.

By increasing the strength of the developer normal negatives may be obtained with as little as one-sixth of the normal exposure.

Intensification with cupric bromide and silver nitrate does not change the size of the grain appreciably, but increases its opacity.

The large grains obtained with strong developers appear to be made of aggregations of smaller ones.

The developer used was one consisting of a solution of ferrous sulphate testing 20 on the hydrometer (Argentometer), to which 60 c.c. of acetic acid per litre had been added. The collodion used contained 1·3 gm. cotton, 0·67 gm. cadmium iodide, 0·44 gm. ammonium iodide, and 0·07 gm. calcium chloride per 100 c.c., and was that regularly used in wet-plate work.

The use of a weak acid pyro developer did not give the desired results, so the ferrous sulphate developer was modified by diluting with an equal volume of water. This reduced the speed of development, and it was supposed that the size of the grain would be increased. Actually the opposite result was obtained. In using this diluted developer, it was found that the exposure had to be doubled in order to produce a normal negative. The average diameter of the grain with normal developer appeared to be 0·002 to 0·003 mm.

From the above it was reasoned that increasing the strength of the developer would increase the size of the grain and decrease the exposure required. Experiment showed that this was the case: using a developer of double strength (ferrous sulphate, testing 40, with acetic acid 180 c.c. per litre) the time of exposure was halved, and the diameter increased to from 0·005 to 0·009 mm.

Upon again doubling the strength of the developer (sulphate, testing 80, to which 420 c.c. acetic acid per litre were added) the exposure was still further decreased and the grain enlarged.—"B.J.," Nov. 15, 1912, p. 879.

Colour-Sensitising Wet Collodion.—W. T. Wilkinson recommends the use of Orthochrome T for colour-sensitising wet-collodion plates. A stock solution of 1 part Orthochrome T in 1,000 parts absolute alcohol is kept. One drachm of this solution added to 5 ozs. of

ordinary iodised collodion makes the latter ready for use next day; it will keep in good condition a month at least.

The dark-room lamp must be covered with green paper, such as Lumière's Virida, two thicknesses being sufficient to screen a 32-candle metallic-filament lamp on 200 volts.

For a filter, place in the lens a piece of Wratten's K.3 gelatine film. The subsequent operations of coating and finishing the plate are as usual.

The exposure will be increased about five or ten times, but can easily be found by one or two tentative experiments, and afterwards standardised.

Orthochromatising the plate will be found very useful when copying yellow originals, together with white ones. Screen negatives can be made direct from coloured pictures, or copies may be made in continuous tone without having to use dry plates, which are somewhat of a nuisance in a wet-collodion dark room.—"B.J.," May 30, 1913, p. 424.

The Gelatino-Bromide Process.

PLATES AND EMULSIONS.

Physical Chemistry of Developing Processes, etc.—In the fifteenth Traill-Taylor lecture, Professor R. Luther dealt with the application of modern physical chemistry to the investigation of such photographic processes as development. He showed, by several examples, the way in which physical chemistry provides information of the changes which take place in such processes, not merely of the final result.—"Phot. Journ.," Nov., 1912, p. 291; "B.J.," Nov. 29, 1912, p. 915.

Resolving Power of Photographic Plates.—Dr. E. Goldberg has described the very simple experimental methods used by him in testing the resolving power of plates. His paper, before the Royal Photographic Society, likewise contains details as to the theoretical and practical results. As regards securing the maximum sharpness, Dr. Goldberg finds that :—

1. In all cases where, with a common or bad lens, the greatest possible sharpness is required, it is necessary to take care that a negative of the steepest possible gradation is obtained. For this purpose a "hard-working" emulsion must be used and full development be given. The same rule also holds where the lens is of the best quality, but the image is affected by the use of a filter or prism. In all these cases want of sharpness due to the resolving power of the plate is of small importance compared to the want of sharpness caused by the optical equipment, because it is far surpassed by the latter.

2. If a first-class lens is used to photograph and only the middle of the picture is required, where the aberations of the rays are relatively small, then our results will be different from case to case.

a. In case fine structures, *e.g.*, narrow neighbouring lines or points, fine drawings, reduced maps, etc., are photographed where all light places of the picture possess the same intensity of light, one need not pay attention to the turbidity factor. With very short exposures the influence of the spreading of a single line or point (turbidity factor) has no value. On the other hand, the resolving limit of the plate in question in these cases plays a particularly important part.

b. But particular difficulty is offered by the exposures where fine lines or points of differing light intensity must be reproduced close together. Such cases are continually encountered with star photography and with spectrum photography. Here lines or points, the light intensity of which is extraordinarily different (*e.g.*, 1 : 1,000,000) lie closely together so that the influence of the turbidity factor surpasses by far all other factors, if a really good lens is used. Short exposures are impossible, as the points of small light intensity cannot then be rendered, but with sufficiently long exposure the spreading of the disc is already so strong that the weakly-lighted points merge into the image of the discs caused by the points of strong light intensity, and therefore cannot now be perceived. Therefore plates must be used which have the smallest possible turbidity factor without regard to their resolving limit.

3. At the present time, process and lantern plates unite a proportionately small degree of turbidity with a good resolving limit. It is, however, not at all impossible that plate makers will succeed in so improving highly sensitive plates as regards the qualities discussed that a good resolution can be attained both with short and with long exposures.—"Phot. Journ.," Nov., 1912, p. 300. "B.J.," Nov. 29, p. 920; Dec. 6, p. 936; and Dec. 13, p. 958, 1912.

Resolving Power.—Dr. E. Lehmann, in measurements of the resolving power of plates, has likewise obtained some interesting results giving the comparative resolving power of wet collodion, dry plates, and the Taupenot albumen iodide plate.—"Zeit. für Repro.," Oct., p. 153, and Nov., p. 167, 1912; "B.J.," Jan. 3, p. 7, Jan. 10, p. 23, and Jan. 18, p. 48, 1913.

Orthochromatic Processes.

Orthochromatic Sensitisers.—P. J. Haler and A. H. Stuart give the following formulæ for colour-sensitising dry-plates:—A, from the yellow to the ultra-violet, and B, for the red end of the spectrum.

To sensitise a plate from the yellow to the ultra-violet, the following may be used:—

A.	Erythrosine (0·1 per cent. solution)	25 c.c.
	Silver nitrate ($1\frac{1}{4}$ per cent. solution)	1 c.c.
	Ammonia (s.g. 0·91)	8 drops.
	Water	75 c.c.

For red-sensitive plates the following is useful:—

B. Pinachrome (0·1 per cent. solution)	5 c.c.
Water	200 c.c.
Alcohol	100 c.c.

In both cases the plates should be soaked in the liquid for three or four minutes and quickly dried.

It should be noted that the plates should *not* be washed after the bath, and drying should be effected as quickly as possible. All operations should be carried on in the dark.—"A.P.," March 24, 1913, p. 286.

Ultra-violet Light-Filter.—Kopp and Joseph have patented the use of derivatives of coumarin which do not possess glucoside characters and which contain hydroxyl, amino, carboxyl, or other groups as absorbents of ultra-violet rays.—Ger. Pat. No. 253,334 of Feb., 1911; "B.J.," Jan. 24, 1913, p. 72.

Destroying Panchromatic Sensitiveness Before Development.—W. J. Pope has been granted a patent for means for destroying the colour-sensitiser in a panchromatic plate to such an extent as to allow of development being done in red, orange, green, or yellow light. A solution containing free nitrous or sulphurous acid is mentioned as a suitable substance for the purpose in the case of sensitive materials rendered colour-sensitive by means of pinachrome, orthochrome, pinacyanol, or similar dyes. It is found that these sensitising dyes may be conveniently destroyed by immersing the exposed but undeveloped negative film during from five to ten minutes in a solution of 1 part each of potassium nitrite and acetic acid in 300 parts of water, or in a solution containing 1 part of sulphurous acid in 400 parts of water by weight. These methods of applying the invention are quoted merely as illustrations. After the colouring matter has been destroyed in the manner described, the negative film may be developed in an ordinary photographic dark-room, illuminated in some ordinary manner with red or orange or green light.—Eng. Pat. No. 328,598, 1911; "B.J.," Jan. 10, 1913, p. 30.

(Both sulphurous and sulphuric acids have been used for the same purpose, but have been found of extremely doubtful efficacy. See "B.J.A.," 1909, p. 652; 1910, p. 525; and 1911, p. 533.—Ed.)

Developing Panchromatic Plates.—Sir W. N. Hartley has worked out modified formulæ of the Balagny acid amidol developer specially applicable to panchromatic plates requiring to be kept for some considerable time between exposure and development. The formula is:—

Water	175 c.c.s.	6¼ ozs.
Amidol	1·5 gms.	23 grs.
Sodium sulphite anhydrous in powder.........................	2 gms.	30 grs.
Sodium bisulphite. Solution of 1·32 sp. gr.; from	3 to 3·5 c.c.s,	50 to 60 mms

The sodium sulphite and the amidol are dissolved first in 10 c.c.s. (5 drams) of water. The solid substances in powder are measured in little tubes mounted on wood or wires to be used as spoons. The solution will keep for a week in stoppered bottles filled completely, but it becomes slightly reddened, though without impairment of its properties.

A flat dish, which is a new one or one that has never been used with an alkaline solution, is placed ready to receive the plate. Close by is a larger dish (inverted), which is to be used as a cover. In a room without any light the plate is removed from the dark slide and placed face upwards in the dish, a previously measured quantity of the developing solution is poured gently over it, and the dish rocked two or three times. The dish is then covered over and left undisturbed. With an efficient cover the light may be turned on and preparations made for further operations. The time required for the development has been found to vary with different batches of the same make of plates between 2½ and 9 minutes, and accordingly it was found best to measure the time of development with a ten-minute sand-glass. The temperature of the solution should be 65 deg. F. or thereabouts, but may be as high as 78 deg. F.

It will be noticed that no bromide is added to the developer. This has been omitted because with plates which developed slowly it proved to be quite unnecessary. But it has been found that some plates which develop rapidly show a slight veil, and to obtain clear glass 5 to 10 drops of a 10 per cent. solution of potassium bromide are added.

Plates kept for many months, which could not have been developed with alkaline solutions or even with ferrous oxalate without marks or stains, presented perfect photographs with this developer.

It is a necessary condition for successful treatment to observe the rule laid down by M. Balagny, that no vessels which have been used for alkaline development be employed, because cracks in the glaze retain traces of alkali. New dishes of granitine ware have been found quite suitable. As the plates used were generally backed with a black pigment mixed with gum, it was difficult to wash them quite clean in the dark-room prior to development; they were, therefore, not washed at this stage, and the developer was consequently never used for more than one such plate.

Fixing Solution.

Hypo	250 gms.	5 ozs.
Water	1,000 c.c.s.	20 ozs.
Sodium bisulphite solution	20 c.c.s.	3 drams.

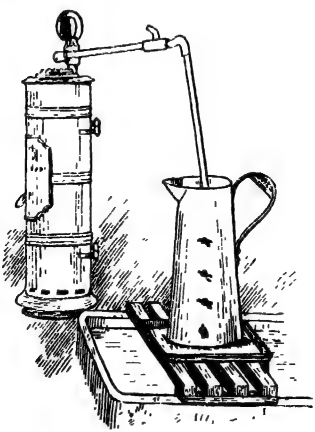
Time allowed for fixing, about twenty minutes. The film may be hardened in a 10 per cent. solution of chrome alum.

To those who use spectrum plates it may appear that the time given to developing and fixing is excessive, but it is the advantage of the acid developer that should it be so the plate is not spoilt: a slight veil which may appear does not impair the printing property of the plate, whereas a premature removal from the bath may

yield a weak and unsatisfactory picture. In some of the earliest experiments it was found that plates had not been spoilt even when they had been left for half an hour in the developer. The difference between the molecular weight of the diamidophenol base and that of its hydrochloride is $\frac{1649}{129} = 1{\cdot}58$, consequently for the same reducing power we must employ approximately 1·6 times as much of the amidol, and 1·5 was found to be sufficient. It was considered that the interaction of the water, the sulphurous acid and the hydrochloride of diamidophenol would result in the formation of ammonium chloride, which would act as a restrainer, hence the reason for the omission of the ammonium bromide.—"B.J.," March 21, 1913, p. 224.

Developers and Development.

Mixing Developers, etc., Quickly.—R. T. Jeffcott recommends a time-saving device consisting of a copper jug provided with outlets at various heights. These can be opened or closed by means of wing-nuts and washers, thus serving automatically to measure different



volumes of water. The water is supplied hot from a gas coil-heater, fitted with swinging delivery arm. After thus quickly measuring the water it is poured over the chemicals contained in a glass or earthenware vessel.—"Amer. Ann. Phot.," 1912, p. 241; "B.J.," Dec. 6, 1912, p. 934.

Paste Developers in Collapsible Tubes.—A. A. Kelly has patented the putting up in paste form of photographic chemicals (developers, etc.) in collapsible tubes. The hole in the end of the tube is made of

such size so as to enable a given length of the protruding paste to represent a given quantity of the chemical. Thus, in the case of a pyro developer, made as below, the orifice in the tube, of 3-16th inch diameter, will yield a column of paste each ½ in. of which represents sufficient developer for 1 oz. of water.

Pyrogallic acid	7 gms.
Sodium sulphite	21·5 gms.
Potassium bromide	1·0 gm.
Potassium metabisulphite	1·0 gm.

Stir these powders until thoroughly incorporated into

Glycerine	7·6 gms.

The method may be applied to other chemical preparations, such as toning baths, etc.—Eng. Pat. No. 27,589, 1911; "B.J.," Jan. 10, 1913, p. 29.

Depth Development with Acid Amidol.—O. Mente has found that the claims made (principally by French workers) as to the advantage of using acid diamidophenol developer for obtaining development first in the depth of the film are largely illusory. He found that in order to obtain the same degree of detail rendering in the shadows, when using the acid amidol developer, it was necessary to give several times the exposure, and if this was done the results obtained were almost equally good in the case of an ordinary developer.—"Atelier," Heft 11, 1912, p. 130; "B.J.," Jan. 31, 1913, p. 84.

Instantaneous Development.—F. J. Mortimer has recommended the use of a highly concentrated solution for the development of plates very rapidly—within a few seconds. He points out that manual dexterity and concentration of attention are necessary. The process is, of course, applicable only to those developers which can be prepared in highly concentrated solution—namely, metol-hydroquinone made with caustic alkali, or the strong single-solution developers, such as rodinal, azol, or certinal. Another formula is the following:—

Hot water	10 ozs.
Sulphite of soda	4 ozs.
Carbonate of potash	3 ozs.

When dissolved, add—

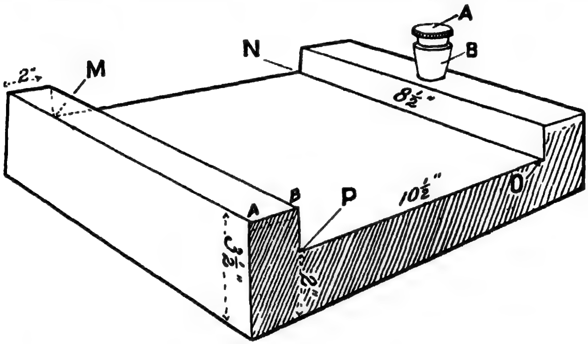
Adurol	½ oz.

The good points of adurol as a developer are not fully appreciated by most photographers. The solution has extraordinarily good keeping qualities. It gives beautifully clean negatives (adurol is also an excellent bromide and gaslight developer), and although similar in some respects to hydroquinone, has none of this chemical's disadvantages in the matter of temperature, etc. The concentrated solution given above should be used as it is. It permits a perfectly developed negative to be obtained in a quarter of a minute. If a still greater concentration is desired with the adurol formula the carbonate of potash can be replaced with about 2 ozs. of potassium hydrate, and the hot water reduced one-half. When making up any of these concentrated developers the first mixture of the chemicals with the hot water produces a pasty mass, which rapidly clears on

stirring in the caustic alkali (sodium or potassium hydrate). The amount of the latter is determined by this means, as only sufficient should be added (and dissolved) to clear the solution.

In using such formulæ for plates the latter are first soaked in plain water, the developer poured cleanly on with a single sweep, the dish rocked a couple of times, and the plates taken out at once, rinsed under running tap, and transferred straight to the acid-hypo bath.—" A.P.," Oct. 21, p. 397, and Oct. 28, p. 433, 1912.

Keeping Developer at Constant Temperature.—T. E. Freshwater has described a simple fitment for maintaining the developing dish at a constant temperature. The construction is shown in the drawing. The tank is made of copper, and is designed to take a 10-in. by 8-in. dish. The design is self-explanatory. If water is added to the height of AB the underside of the piece of metal, MNOP,



upon which the developing dish stands, is always in contact with the water enclosed in the tank. On experimenting, Mr. Freshwater found that when water was placed in the tank at 95 degrees Fahr. the developer rapidly approached 66 degrees Fahr., and remained at approximately the same temperature for an hour and a-half.—" B.J.," Jan. 17, 1913, p. 53.

A simpler method of keeping the solution in a developing dish of proper temperature consists in the use of an ordinary flat-bottomed earthenware hot-water bottle (Fig. 1) supported on a stand such as

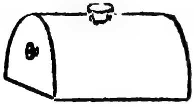


Fig. 1.

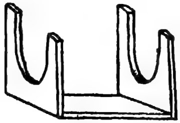


Fig. 2.

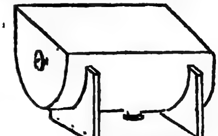


Fig. 3.

that shown in Fig. 2. Fig. 3 shows the bottle inverted on the stand, the developing or other dish being then placed on it.—" B.J.," Feb. 7, 1913, p. 109.

Pyro Stains.—F. A. Thain recommends as an effective preparation for removing stains and discolorations on the hands caused by pyro developer a material sold as "Parazone."—"B.J.," Jan. 24, 1913, p. 75.

Diamidophenol Developer Finger Stain.—"N. G." advises the adoption of the simple method of having a small deep dish close handy containing a weak solution of nitric acid and water, into which the fingers are frequently dipped. Result—clean fingers. If workers want clean nails, let them soak their fingers for about ten minutes in a strong solution of sodium sulphide, and the stain should then be able to be rubbed off with a piece of wood; but let them beware of doing this sort of thing daily.—"B.J.," Jan. 3, 1913, p. 14.

Rapid Development.—R. L. Boyd recommends the following formula for use when developing negatives in considerable number, as when dealing with amateurs' plates commercially:—Water, 20 ozs.; metol, 24 grs.; hydroquinone, 96 grs.; sulphite, 2 ozs.; soda hydrate (caustic soda), 64 grs. Dissolve in order given. Great care must be taken to cover plate with one sweep, as the image appears as soon as the developer touches the film, and the plate is fully developed in forty-five to sixty seconds. With roll film, best dilute with one or two parts of water to avoid markings; also soak film in water first, and pass very quickly from end to end in developer.—"B.J.," June 27, 1913, p. 498.

Metol Poisoning.—It has been found, in the case of a member of the "B.J." staff, that the skin poisoning effect of metol appeared only after the use of one particular formula out of the two metol-hydroquinone formulæ he was accustomed to rely upon, and since then he has been using the other formula repeatedly without any ill effects at all up to the present time. Almost the sole difference between the formulæ is that one contains sodium carbonate as the alkali and the other the potassium carbonate, and while the former is the injurious one, the latter appears to have no effect whatever, even though his skin has by now evidently become very sensitive. It would thus seem that though the trouble is always attributed to metol, it by no means follows that metol alone is the prime cause, and possibly the collection and summation of sufficient evidence would show that the metol soda combination is the real enemy.—"B.J.," Dec. 13, 1912, p. 950.

Concentrated Single-Solution Developer.—M. J. Desalme has given the following instructions for making a concentrated solution which requires mixing with thirty to forty times its bulk of water to form the working developer. Hydrochloride of paramidophenol (75 gms.) is dissolved in 600 or 700 c.c.s. of hot water. If the solution is not quite colourless it is boiled for a few minutes with 10 gms. of animal black (previously washed with acid) and then filtered.

10 gms. of soda sulphite cryst. and 35 gms. of dry soda carbonate are then dissolved in 200 c.c.s. of warm water and added to the solu-

tion. A white precipitate of paramidophenol base is obtained, and after allowing the mixture to cool, is filtered off on cloth. The paste which remains on the cloth is allowed to drain until its volume is not greater than about 300 c.c.s.

It is then placed in a glass or porcelain vessel and 100 c.c.s. soda bisulphite lye of 35° Beaumé added. Next is added, little by little, caustic soda solution of 40° Beaumé to dissolve the precipitate. About 80 c.c.s. is required, and as soon as the solution has cleared a few drops of the bisulphite solution are added until there is a very slight permanent precipitate. Water is then added to make a total bulk of 500 c.c.s., and the mixture then filtered and bottled.

For use, this stock solution is mixed with from thirty to forty times its bulk of water. As it readily oxidises in the air it is best to put it up in small bottles of ½ or 1 oz. capacity, using these to make 15 or 30 ozs. respectively of the working developer.—"Bull. Soc. Fr. Phot.," May, 1913, p. 156; 'B.J.," May 30, 1913, p. 415.

Sulfinol Developer.—Capt. R. Hergeth has given particulars and formulæ for the use of a new developing substance, Sulfinol, made by the Société des Matières Colorantes et Produits Chimiques de Saint Denis, 105, Rue Lafayette, Paris.

Sulfinol is a slow-acting developer, the image appearing in about three minutes. It is of special interest, as a developer for bromides, since the colour of the prints obtained is somewhat yellowish-brown.

For the development of bromide papers an excellent Sulfinol developer is as follows :—

Soda sulphite, cryst.	40 to 50 gms.
Sodium carbonate, anhydrous	30 gms.
Sulfinol	10 to 15 gms.
Water	1,000 c.c.s.

The sulphite and carbonate are dissolved in 200 c.c.s. of water, the Sulfinol added, and the mixture then diluted to 1,000 c.c.s. Addition may be made of potass. bromide to the amount of ½ gm., but development is then very much longer.

By combining Sulfinol with hydroquinone a developer is obtained which works much more rapidly, and can be used for both plates and papers. It yields excellent negatives of good gradation without excessive contrast, and it keeps well. As with Sulfinol alone, it should be made up with carbonate of soda. A suitable formula is :—

Soda sulphite, cryst.	50 gms.
Sodium carbonate, anhydrous	50 gms.
Sulfinol	10 gms.
Hydroquinone	5 gms.
Water	1,000 c.c.s.

The developer is made up in the way described for Sulfinol alone, the hydroquinone being dissolved at the last. It yields good results without bromide. The colour of the deposit is a pleasing warm brown, the image appearing in about six seconds and being completely developed in two minutes. These are the times for the first

two or three prints developed in a suitable quantity of bath; later prints come up in from one to two minutes and are completely developed in about six minutes.

The developing solution, which at the start is of very light violet tint, becomes of brownish hue after about the tenth print. It then contains an oxidation product consisting of fine crystalline needles of light brown colour, and about 3 mm. in length. It slightly stains the fingers a light brown, but has no effect as regards stain or veil upon the prints. The Sulfinol-hydroquinone developer may be said to form a valuable means of producing prints or transparencies of warm colour by direct development. In spite of its slow developing action, it is an excellent means for this purpose, and will doubtless be accepted as a useful alternative to methods of after-toning.—"Bull. Soc. Fr. Phot.," Jan., 1913, p. 40; "B.J.," July 25, 1913, p. 572.

Chloranol Developer.—A. and L. Lumière and A. Seyewetz have worked out a compound developer on the lines of metoquinone (quinomet). Whilst this latter is a compound of metol and hydroquinone, Chloranol is a compound of metol and chlor-hydroquinone. Chloranol is more soluble in water than metoquinone, also it keeps well even without sulphite and exceedingly well with sulphite, even with alkali added. It can be used as a developer without sulphite, but then works very slowly. It can be used without bromide. The following are formulæ for average use:—

A. DEVELOPMENT FOR NORMAL TIME.

(*a*) For Portraits.

Water	1,000 c.c.s.
Chloranol	5 gms.
Soda sulphite, anhydrous	30 gms.

(*b*) For Normally Exposed Negatives.

Water	1,000 c.c.s.
Chloranol	5 gms.
Soda sulphite, anhydrous	30 gms.
Potass. bromide, 10 per cent. solution	10 gms.
Soda carbonate, anhydrous	5 gms.

In this formula the soda carbonate can be replaced by 10 c.c.s. of acetone, or the sulphite and the carbonate together by 30 gms. of formosulphite.

(c) For Under-exposed Negatives.

Dilute one part of the developer *b* with two parts of a solution of carbonate of soda containing 5 gms. per litre.

(*d*) For Over-exposed plates.

Use developing bath *a* and add to it from 2 to 20 c.c.s. of 10 per cent solution of potassium bromide, according to the degree of over-exposure. We may also use a concentrated developer prepared with Chloranol and acetone with sulphite of soda.—"B.J.," Aug. 8, 1913, p. 604.

Duratol-Hydroquinone.—Dr. Malcolm Dean Miller writes highly of a developing formula compounded with Duratol and hydroquinone, the former a new developer of Messrs. Schering. Duratol is not suited for use with ordinary sulphite; potass. metabisulphite should be used. But if when making a developer the sulphite and carbonate, both anhydrous, are intimately mixed or dissolved before adding the developer no precipitation can take place.

A suitable one-solution formula is as follows :—

Water	40 ozs.
Duratol	15 grs.
Hydroquinone	60 or 75 grs.
Sodium sulphite, anhydrous	1 oz. (av.)
Sodium carbonate, dry granular	$1\frac{1}{2}$ or 2 ozs.

The smaller quantities are preferred, as they remain in solution even at low temperatures, and do not pile up the density in the high-lights to such an extent as do the larger. In mixing the solution the developing agents are dissolved by stirring in the water, and the sodas are then added after being very intimately mixed in the dry state. The resulting solution is faintly yellow in colour.. If stored in well-corked bottles, it discolours very slowly; but a rather deep yellow coloration shows that it has oxidised sufficiently to be unreliable, in which condition it develops slowly and gives a weak image. Reducing the sulphite increases the speed of development at the expense of keeping quality, but adding more sulphite is likely to cause crystallisation.

This stock solution is used full strength for gaslight papers and slides, requiring, in most cases, no addition of bromide to keep the whites clear, and yielding a fine blue-black colour. A pure platinum black is had by adding one drop of 10 per cent. potassium bromide to each two ounces of developer; "professional" papers, such as Cyko, give warmer blacks with from one to two drops of saturated bromide solution to each ounce. For films and plates the stock is diluted with an equal volume of water. Development is rapid, and factors from nine to fifteen may be employed, according to the amount of contrast one desires—twelve is perhaps best for negatives intended for P.O.P. The same dilution is used for bromide paper. For bromide paper, the developer is free from all the minor defects of other agents, and yields a better colour with complete freedom from the use of bromide.

For tank development this formula is quite suitable, the dilution varying as follows :—

15 minutes' development at 65° : 1 part stock, 1 part water.
22 minutes' development at 65° : 1 part stock, 2 parts water.
30 minutes' development at 65° : 1 part stock, 3 parts water.

The 1 to 2 dilution gives exceedingly fine results, with no tendency to fog, even if the temperature exceeds 75 deg. When diluted for tank use, the solution seems to have remarkable keeping qualities, and these can be still more enhanced by adding to each 40 ozs. of stock $2\frac{1}{2}$ ozs. of acetone-sulphite solution 1 in 7; or $7\frac{1}{2}$ grs. of

anhydrous sodium sulphite to each ounce of water used for diluting, in accordance with the observations of Piper and Mees.

Glossy papers developed with Duratol-hydroquinone show less tendency to stress marks than with other developers, even without the use of iodide, and the colours are therefore better. Development is considerably slower on paper than with metol-hydroquinone, lasting from three-quarters of a minute to two minutes, thus allowing the handling of five or six prints at once. Care must be taken not to overprint if blue-black or pure black tones are desired. No staining or fogging occurs at temperatures up to 75 deg., and the adjustment of bromide, so troublesome with metol combinations, is quite obviated.

The formula already given can be made up in two solutions by the use of potassium metabisulphite as a preservative. It is essential to dissolve the metabisulphite first: forty grains to the pint is sufficient. Dissolve this amount in a pint of cold water, and, when thoroughly dissolved, add the developing agents and dissolve them by stirring. In the other pint of water dissolve the two sodas. Mix equal parts for use, or dilute as required. In place of sodium sulphite, one-fourth the weight of acetone-sulphite may be used. Even with this relatively expensive salt, the cost for the batch of solution is only about fourpence.—"A.P.," June 16, 1913, p. 584.

Developing Night Photographs.—R. Williamson, in a paper before the Royal Photographic Society, has described the developing formulæ and manipulation which he uses in the treatment of plates exposed on indoor and outdoor night subjects and including bright high-lights, such as arc lamps, etc., as well as deep shadows. The method is varied according to whether the subject falls within one or other of the following classes:—

1. Negatives where the contrast between light and shadow is small, or the lights themselves absent.
2. Those negatives containing strong artificial lights, where the contrast between high-light and shadow is very extreme.
3. Those negatives with a short exposure to portray moving traffic or objects.

As regards Class 1 the conditions are practically those of daylight work, and an ordinary developer is used providing that exposure has been sufficient.

Most subjects come in Class 2, and for these the method employed is to start with a moderate proportion of alkali and also to dilute the developer with water as development proceeds. Generally the formula and method are as follows:—

Start operations by mixing a developer from the following:—

No. 1 Solution.

Pyro	1 dram.
Metabisulphite of potassium	½ dram.
Water to make	5 ozs.

No. 2 Solution.

Soda carbonate	½ oz.
Soda sulphite	½ oz.
(dissolve separately)	
Water to make	10 ozs.

For each dish take ½ oz. of No. 1, 2 drams of No. 2, and add water to make 2 ozs., with 1 to 4 drops of 10 per cent. potassium bromide. Flood the plate, taking the usual precaution against air bubbles. Rock the dish occasionally for five minutes, then add another 2 drams of No. 2, and in another five minutes the high-lights should appear, showing the exposure is correct for this developer. Upon the appearance of the image dilute the developer with 1 oz. of water, and continue diluting as the density increases.

Remove the plate from the developer, rinse under the tap for a few seconds. When the high-lights obtain the required density, then place in a dish of plain water for about ten or fifteen minutes to soak. This soaking enables any developer still remaining in the emulsion to act and bring out the finer shadow details or under-exposed parts. Then fix in acid hypo.

Diluting the developer at the proper time is most important. It prevents the high-lights acquiring too much density, whilst allowing the shadows and other under-exposed parts a chance to build up detail during the later stages of development.

In case the image first appears in less than ten minutes, the negative has been over-exposed. The developer must be further diluted, and one drop or two more bromide added and sometimes a little of No. 1. On the contrary, if the first appearance is over ten minutes, the negative is under-exposed. The developer must not be altered, but continued until the high lights build up some little density, when it must be diluted, and often a little of No. 2 is required to produce the necessary density.

As regards using bromide, it is found that the bset temperature for avoiding halation and developing shadow detail is 55 deg. F. At a higher temperature than this more bromide must be added : less is used if the temperature is lower. The range of variation may be put at from 1 to 4 drops of 10 per cent. potass. bromide solution in 2 ozs. of the working developer given above.

With a powerful electric light in the foreground, accompanied by shadows not very dark, and with sufficient exposure to give a small reversal of the electric light, 4 drops are necessary in the developer already described, but when the lights are weaker and shadows darker less bromide is required.

Practically less powerful lights mean less contrast, and less contrast means less bromide. Therefore, as the contrast diminishes, so does the quantity of bromide, until we arrive at a point where the lights are weak and distant or the lights absent, then the contrast between light and shadow is so small that bromide is unnecessary, and may be omitted.

Instead of using additional bromide to restrain the high-lights, it is better to start development by bathing the plate in the No. 1 or pyro solution containing 4 drops bromide for a few minutes, then add the No. 2 in the manner already described.

In dealing with subjects of Class 3, such as snapshots in streets or theatres, the aim is to restrain over-exposure in the best lighted parts and yet not to destroy fine under-exposed detail. For this, development is started by bathing the plate for half or one minute

in ½ dram No. 1 pyro solution to 2 ozs. water, without any bromide, at a temperature not less than 60 deg. F., then add to the pyro 1½ drams of No. 2, and continue to add 1½ drams every two minutes and stop when the image first appears. Then dilute the developer by adding 1 oz. of warmer water, say, at 70 to 75 deg., to raise the developing temperature, and continue to add this warm water as the density of the high-lights increases, but should at any time the high-lights show halation, add 1 drop of bromide.

Should the negative show deficiency in shadow detail, remove the plate before the required density is reached, place it to soak in a dish of plain water at the same temperature as the developer whilst preparing weak solutions to coax the shadow or under-exposed details. For this purpose take two dishes, in each place 6 to 8 ozs. of water, keeping the temperature of all dishes alike. Add to one dish 10 to 15 drops of No. 1, and to the other 10 to 15 drops of No. 2. The detail is coaxed by placing the negative first in one dish and then in the other, and whilst this is proceeding the temperature reduces to that of the dark-room and the fixing-bath.

The time taken in development is generally one and a-half to two hours, but in some instances occupies about three hours for development, soaking, and fixing.

Theatre scenes are developed in the same way. They are rather easier, because they generally contain more light. This shortens the development, but here again detail must be coaxed, if required, by using two weak solutions named above.—"Phot. Journ.," May, 1913, p. 162; "B.J.," June 20, 1913, p. 474.

Two-Solution Tank Development.—Harold Baker recommends the following method of developing in tanks on the ground that in general work of portraiture it gives better quality to the high-lights and deepest shadows, avoiding bare glass in the latter, as well as the blocking up of delicate tones in light draperies.

The method is the employment of a concentrated developer and of two separate tanks. The rackful of plates is first immersed in the solution of the developing agent—pyro, metol-hydroquinone, or whatever is used (generally called "No. 1" in makers' formulæ). It is left in this for about a minute if the solutions are fresh, or for longer if they are at all stale, and then, without washing, the rackful of plates is transferred to the second tank containing an equally concentrated alkali (or No. 2 solution) for a minute or more, as may have been found necessary to give the proper density. After rinsing, the plates are removed from the rack and fixed.

The No. 1 solution appears to keep indefinitely, all that is required being to make up its bulk from time to time; but it should not be left in the tank, as it is nearly always slightly acid, and after a time the acid attacks the nickel coating of the tank, making the solution useless and, of course, injuring the tank. After use, it should always be poured off into a bottle, and occasionally filtered to remove any particles of gelatine, etc., from the edges of the plates.

The tankful of No. 2 will need renewing much oftener than No. 1, as a considerable quantity of No. 1 is carried over from the first tank; it speedily becomes discoloured and loses its strength. If a large number of plates are to be developed at once, the No. 2 solution may be used a good many times, but it will not be safe to use it the following day. If any doubt is felt about its condition, it is quite easy to develop one plate; if a long time is necessary to obtain proper density, a fresh solution should be used.—"Phot.," May 20, 1913, p. 411.

Recovering Fogged Plates.—H. Hickox, jun., gives the following formula for restoring exposed undeveloped dry plates for use again in the camera. Soak in a porcelain tank in the following for 15 minutes:—Potassium bichromate, ¼ oz.; ammonium bromide, ¼ oz.; water, 20 ozs. After washing for 30 minutes, wipe the films with a pad of cotton-wool and stand away to dry. The whole is performed, of course, in a perfectly safe light. The plates treated in this way (Barnet Studio) are excellent for copying purposes, particularly if a vigorous negative is required. The plates are reduced to about half their original speed, but this is immaterial.—"B.J.," May 16, 1913, p. 384.

Fixing, Washing and Drying.

Hypo Strengths and Times for Fixing.—C. Welborne Piper has made measurements of the relative times required for visible fixation in hypo solutions of different strengths and at different temperatures. His results show that, as regards temperature, hypo solutions of very different strengths fix with nearly equal rapidity when the temperature is high—that is to say, when it is as great as 60 deg. or 70 deg. C.—altogether beyond the limits of photographic practice.

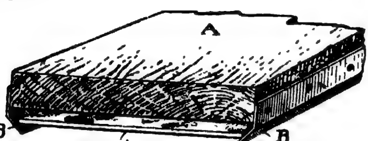
As regards the strength of the hypo solution (used at ordinary temperatures), both excessive strength and excessive weakness are found to reduce the speed of fixing. A bath containing 12 ozs. of hypo per pint is as slow as one containing only 2½ ozs. It would seem that, as a general rule, the best strength of bath, as regards speed and completeness of fixing, is one containing about 8 ozs. hypo per pint of water.—"B.J.," Jan. 24, 1913, p. 59.

Mixing the Chrome Alum Hypo Bath.—In making up the chrome alum fixing bath no difficulty will be met with if the directions given under "Fixing Baths" in the "Formulæ" section be followed. In this formula 2 ozs. of sodium sulphite are first dissolved in 6 ozs. of water, and then 2 ozs. are added of a dilute solution of sulphuric acid containing 1 part of acid in 16 parts of solution. This mixture is then poured into a solution of hypo made by dissolving 1 lb. of hypo in 48 ozs. of water, and, finally, 8 ozs. of a 1 in 8 solution of chrome alum is added. The result is a perfectly clear, green solution containing, roughly, something between 4 ozs. and 5 ozs. of hypo to the pint, and of the right strength

for negatives, though, perhaps, a little too strong for prints. For bromides we dilute with 1 part of water to 2 of solution.

If the alum is added before the sulphite a precipitate will be formed, but if this error is not made, the next most probable cause of failure is the use of bad-quality sulphite. The function of the sulphite is the prevention of any deposition of sulphur, and the quantity given is ample for this if of reasonably good quality. If, however, it is very impure, and contains less than half its weight of sulphite, as may be the case with very cheap samples, then, of course, the proportions are upset, and trouble may ensue. One other likely mistake is omission to use hot water in making the solutions. All the solutions being strong ones—1 in 3 sulphite, 1 in 4 hypo, and 1 in 8 chrome alum are all strong solutions—cold water is of no use for making them. Each solid must be completely dissolved before the mixture is made, and hot water is essential for the purpose.—"B.J.," Nov. 8, 1912, p. 854.

Washing Plates in the Bathroom.—T. H. Holmes describes a useful fitment serving to wash plates in a large bulk of still water, such as is available in a bathroom. The plates are held, film downwards, between a pair of brass runners, BB, attached to a piece of light wood, such as white pine. This should be about 1 in. thick and a little larger than the size of the plate. The brass strips are bent inwards so as to form a pocket into which the negative, C, is readily slid.



The hypo will be washed out of a plate so suspended in a very short time, and, in addition to the small cost of the device, there is absolutely no danger of grit or sediment settling upon or adhering to the wet film. If by chance the water should drain away, the projecting metal edges will prevent the film of the negative from coming in contact with the bottom of the tank or bath.—"Cam. Craft," Nov., 1912, p. 519.

Drying Negatives by Electric Hot Blast.—John H. Gear, at the Royal Photographic Society, demonstrated the use of an electric blower providing a strong current of hot air and permitting of negatives being dried in a very short time. The speed of drying was conditioned by the distance of the blower from the rack full of negatives. The temperature at 3 ft. away when the normal temperature of the room was 50 deg. F., would reach a maximum of 68 deg. in four minutes. At 2 ft. away, under the same conditions, the temperature would rise to 70 deg. in 60 seconds, and the maximum temperature of 77 deg. in four minutes. At

18 ins. 85 deg. was obtained in five minutes, and at 12 ins. a temperature of 100 deg. in four minutes and of 125 deg. in six minutes.

It was stated that no danger had been found as regards running of the gelatine. The cost of the blower is about 50s. It is obtainable from Parker and Smith, 55, Bridgwater Square, London, E.C. —"Phot. Journ.," Jan., 1913, p. 2; "B.J.," Jan. 31, 1913, p. 82.

Retouching.

A Clear Retouching Varnish.—W. H. Smith gives the following formula for a quick-drying, crystal-clear varnish, which can be applied to either glass or film and takes the pencil readily. It is made by mixing equal parts of 2 per cent. solution of celluloid in amyl acetate and methylated spirit.

A little resin may be dissolved in the mixture in order to give a "bite" to the film, but too much resin renders it fragile and liable to break up. A formula for such varnish containing resin is a mixture of equal parts of the three following:—(*a*) amyl acetate; (*b*) 1 per cent. solution of pale resin in acetone; (*c*) 1 per cent. solution of tough soluble cotton in acetone. For retouching, the varnish can be rubbed on the film or glass with a rotary motion of the finger, stopping when it just becomes tacky, or it can be flowed on in the usual way, the nature of the fluid making this an easy operation even to the inexperienced. For blocking-out upon, such a film should be ideal. *Tough* soluble cotton should be asked for, the tougher the cotton the tougher the varnish. Chemists, such as Hopkins and Williams and Townson and Mercer, supply small quantities. It is generally sold in a damp condition, and should be spread out on blotting paper to dry. The same solution, with the addition of any usual colouring dye, makes a good cold-lacquer for metals. Only one coat is possible, as any attempt to apply a second would raise the first.—"B.J.," May 16, 1913, p. 388.

Retouching Medium.—"Retoucher" gives the following as a medium used for many years with satisfactory results:—Place together in a jar ¼ oz. powdered resin, ¼ oz. gum dammar, ½ gill American turpentine, ¼ oz. Venice turpentine. Heat and dissolve, then bottle off until twelve months old. The mixture will have rather a muddy appearance at first, but will go quite clear in time. —"B.J.," June 27, 1913, p. 498.

Eyestrain in Retouching.—Harold Baker comments on the mistaken plan in retouching of endeavouring to see every stroke made by the pencil; the eyes will be very much strained, and the retouching will be bad. It will have a peculiar sandy and scratchy appearance, and will look uneven and patchy. The retoucher will produce his best work without eyestrain at all, the result will be even, and the modelling preserved. The whole secret seems to be to work at such a distance from the negative that the general effect of many strokes is seen, and not each individual line produced by the

pencil strokes or dots. Just such a distance as the water-colour artist works at when he is "stippling" the face in a portrait or a large surface when an even tint is required.

As regards illuminating the negative, a mirror for reflection of the light is the worst means; clean white paper is best, or, if the negative is extra dense or the light poor, a sheet of *matt* aluminium. The retouching desk is often at fault. A good desk should be at least 18 ins. square inside, with curtains at the sides, but not behind the head. If the work has to be done in a reception-room or any room with light coming at the back of the retoucher, a folding screen should be used to cut off such light; and it need not be at all unsightly, even in a reception-room. It is far more healthy and convenient than a curtain over the head, and better looking, too, and the retoucher does not emerge with tousled head to attend to customers. The series of carriers to fit the various sizes of plates are quite useless, as the position of the head is so often different, and they do not allow movement of the negative in different directions. Besides, too, they show far too much of the negative uncovered, which is trying to the eyes. A hole about 3 ins. square near the middle of the desk is best, so that the negative may be moved freely in any direction, according to the angle of each pencil-stroke. Sometimes a piece of black card with a smaller hole, even an inch in diameter, will be useful to lay over the negative when small heads are being retouched. Retouching constantly must, of course, be tiring to the eyes, but *eyestrain* may be avoided to a great extent if the hints given above are carried out.—"B.J.," Dec. 20, 1912, p. 978.

Retouching by Artificial Light.—A number of recommendations as to the best means of providing a comfortable artificial light for retouching work are given by assistant readers of the "B.J." The two

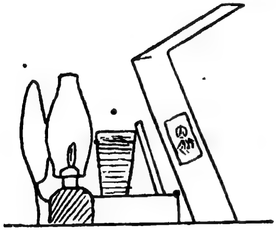


Fig. 1.

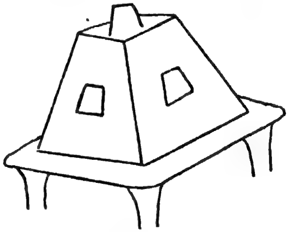


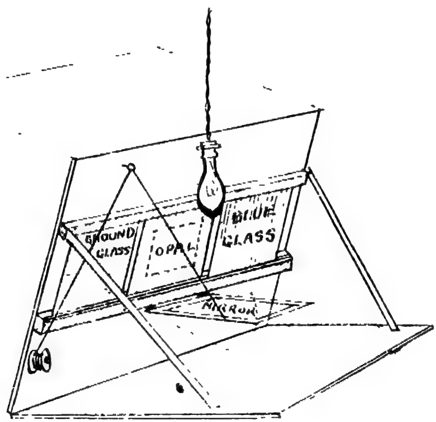
Fig. 2.

essentials in such illumination are (1) great diffusion of the light, either by reflecting it from a matt surface or by transmitting it through a diffusing medium, such as single-flash opal, and (2) using a light of bluish colour, either by means of a blue screen or reflector.

"J. L." advises placing a tumbler full of blue-tinted water in front of an ordinary oil lamp to get the magnified effect seen with

the well-known globes in chemists' shops. A piece of fine ground glass is then leant against the tumbler, and there, after a little manœuvring, is the ideal illuminant for the retoucher (Fig. 1). A little Prussian blue (water-colour) is used for the water, but washing blue serves the purpose equally well. There is no need to get an expensive lamp. In the winter months such light is greatly superior to weak daylight, and one never suffers fatigue with this light, even after a big day's work. Where two or more retouchers are at work, economy may be effected by using a lamp of the circular-wick pattern and having a desk made for four, as illustrated (Fig. 2). Of course, in this case four tumblers will be required. Employers with limited space will find this quadruple desk, used with a square table, a great convenience and a saving of room and light.—"B.J.," Jan. 24, 1913, p. 67.

A. Handford uses a desk fitted as shown in the drawing. The negative is laid against the opal, and the desk is used, as shown,



in daylight. At night the lamp is switched on and the blue glass pushed along its groove over the opal. The angle of the mirror can be adjusted by turning the reel, and variations of the light during the daytime thus compensated for.—"B.J.," Jan. 31, 1913, p. 91.

Blocking-out for White and Black Backgrounds.—D. Berlin recommends the use of yellow dye instead of opaque for blocking-out negatives where the background in the print is required white. The dye method is chiefly of use when printing on bromide or gaslight paper. It is far easier to work than where an opaque blocking-out mixture is used. A suitable dye is the yellow of the Vanguard Company, or auramine of Messrs. Griffins. Both will dissolve in hot water : for use only a weak solution is needed. The

plates should have been well washed in hypo, otherwise the dye is liable to fade on drying.

The essential part of the method is to go over the film immediately before painting with the dye with a piece of wet cotton-wool on which a little oxgall is sometimes needed to overcome any greasiness. The object of this preliminary moistening is to allow the dye to diffuse slightly beyond the edge of the brush mark, and the extent to which it does this is, of course, dependent on the amount of wet applied to the negative, and to some extent on the strength of the dye. A very few trials will show the best for the work in hand; for example, plates which have been hardened need more wet.

The great bugbear of all who "block out" is a part of a subject such as ladies' hair or a fluffy dog, but this dye method is just the thing for such cases, as one can go over the edge of the part with a wash of weak dye, which will add a little density to the background without clogging the hair, etc., and then proceed, as usual, with a stronger wash when stray bits not wanted to print can be taken off without leaving a sharp edge.

To remove the dye, all that is needed is a very weak bath of hydrochloric acid.

"Blocking" Out for Black Background.

For subjects where a black background is effective, such as statuary, glass ware, wedding cakes, some portraits, etc., a satisfactory method of clearing away the deposit around the subject proper is as follows:—

The negative to be treated must be thoroughly well washed, and should preferably not be one which has been hardened either by chemical means or by age. These *can* be treated, but require more care and patience. The dry and cold negative is coated with collodion which has been diluted with an equal portion of a mixture of ether and methylated spirit. More of the diluent will be required at a later stage for removing the collodion. As soon as the collodion is dry the plate is ready for painting out. This is done with a solution of iodine made by taking a saturated solution of potassium iodide and dissolving as much iodine as it will take up. It is best used in a little squat bottle that will not easily get upset, and no harm will result from a few undissolved flakes of iodine at the bottom; half an ounce of solution will hold quite a quarter-ounce of iodine, and will go a very long way. As the iodine is rather apt to spoil the brushes, it is a good plan to keep one for the outline and have some water handy to wash it out with and in which to leave it soaking while filling in with another brush, which may be any old spotting brush or a penny camel-hair mop. Special brushes should be kept for this process, and another set for use with dyes.

Removing Iodine and Collodion.

In painting out the background with iodine special care must be taken not to go beyond the boundary, as the strong solution will immediately convert the image into silver iodide. The brush should be kept well charged with solution, which should go on the plate

with a good rich red or orange tint. Should it go on yellowish it *shows either that* the solution is weak or that the brush is not sufficiently charged. As soon as the outline has been done with the fine brush the plate is laid flat and a plentiful quantity of solution laid on with the mop, the whole procedure being almost exactly like "opaquing," except that it is easier owing to the iodine solution being somewhat transparent. The plate should then be left for some time till the moisture has been absorbed and the film appears surface-dry. The negative is then examined by transmitted light, when most of the painted portion will look a horrible mess of red and yellow patches, but most likely there will be places where the colour is not quite clear and appears of a greyish tint showing that the silver in those parts is not all converted. These patches can also be seen on examining the back of the plate, where it is easy to see if the iodine has struck through. These places are then given another coating of solution and again allowed to dry in a horizontal position. The next thing is to plunge the plate under a fairly strong stream from the tap for five seconds and place it in a draining-rack; the object of this is to wash off any iodine from the surface more quickly than it can affect any parts of the image it may run over, and at the same time it adds more moisture to that which is already in the film and allows it to penetrate right into the gelatine till it touches the glass, but it is important that no longer than five seconds be given, or the edges of the subject may be affected. It is also advisable to blot off any surplus water. The negative is now left to itself for some time—say, twenty to thirty minutes—and unless the image was a very dense one indeed there will be no traces of grey left (if there are, a touch of iodine will remove them), and the red and yellow will be seen changing to white. At this stage the plate is put into a bath of hypo or sodium sulphite, which will destroy the red colour of the iodine. As soon as this takes place the plate must be taken out and well rubbed with cotton-wool saturated with the ether and spirit mixture to remove all traces of collodion, which is very soon done, and the negative is again put into a strong hypo bath until the white iodide of silver disappears and leaves the film perfectly clear, when, of course, all that remains to be done is to wash and dry. Should the plate have a yellow image remaining, through having been developed with pyro, this will seldom print, but if it should it can be entirely removed by a weak hydrochloric acid bath, followed by only a short rinse. But negatives cleared in this way sometimes affect certain printing papers, especially self-toning ones, and should, therefore, be varnished.

Mawson's enamel collodion and the B.P. variety for the above purpose may be used with equal success, though perhaps the Mawson works more easily. The collodion is an essential part of the process, and it enables the finest detail to be successfully dealt with, but if it is not entirely removed before drying the plate it is apt to cause fine cracks. If the even black backgrounds produced in the prints by this method are not satisfactory, a little gradation can be introduced by working on the back of the negative by air-brush or

with matt-varnish and crayon, or possibly the new film negatives of backgrounds can be used to advantage in some cases.—"B.J.," May 9, p. 358, and May 16, p. 376, 1913.

Titles in Black on Postcard View Negatives.—A. V. Chandler writes titles on view negatives by working directly on the film with a fine needle mounted in a wooden handle (Fig. 1). A needle placed in a retouching pencil-holder in place of the pencil is good, but better a short stumpy handle than can be gripped between the thumb and fingers. In the use of the needle a certain amount of skill is required, but a line or two of lettering on an old negative soon gets one into the way.

It is important that the negative must not be too dry, or the needle-point will not travel easily, and with extra force it has the knack of jerking all at once, making a nice dig across the film. Neither must it be too wet; if so, the film "jags," or rolls up under the point. A negative dried in a cool draught works admirably, and if a surface is too dry the remedy is to leave it in the dark room all night, as the majority of such rooms are somewhat cool and damp.

Fig. 1.

The needle-point must be kept keen, and this can be done by rubbing it on a sandstone or sandpaper block in the same way as retouching pencils.

Titling in this way cannot, of course, be removed, but very few require such treatment, since negatives such as these are seldom put to any other use. If, however, a print is desired without tilting it is a simple matter to vignette the same out if inserted in the sky; or, by placing the negative in clean water for a few minutes the film expands and the openings made with the needle will "close up."

The negatives, when titled in this way, must not be rubbed, as with medium, etc. This must be done beforehand, otherwise the lettering will be "clogged," and nothing will put things right.—"B.J.," Mar. 14, 1913, p. 193.

Retouching on the Glass Side.—A new preparation, "Billdup," of the Vanguard Co., enables retouching of all kinds to be done very rapidly and to a degree which is very great compared with the use of pencil on the usual medium. The glass side of the negative is flowed over with the varnish which dries in about two minutes; the negative is then laid glass side outwards on the retouching desk and worked up with pencil or a special stumping graphite used in a dry camel hair pencil to blend the work together. Work may also be done on the film side after coating with "Billdup," and blocking out, removal of pin-holes, etc., effectively carried out

in this way. The method is applicable not only to portrait negatives, but to those of landscape and other subjects, since the perfect transparency of the varnish coating allows the effect of every stroke being clearly seen. Negatives so worked up require to be printed by diffused light or through tissue paper or ground glass in order to avoid sharp outlines showing in the prints.

V. PRINTING PROCESSES.

Positives Direct.

Ferrotype Developer-Fixer.—Dr. Lüppo-Cramer has recently given the following formula as one proving reliable for simultaneous development and fixing of ferrotype portraits:—

Soda sulphite, cryst.	31 parts
Hypo	248 parts
Soda carbonate, cryst.	8 parts
Potass. bromide	8 parts
Water	800 parts
Hydroquinone	20 parts
Ammonia (sp.gr. ·91)	45 parts

This formula, given as that of Mountford, closely resembles one for the same purpose contributed to the "B.J." of January 21, 1910, by an American reader, presumably for collodion ferrotype plates. Dr. Cramer states that there is now a movement towards gelatine plates on the part of those who work the "while-you-wait" portrait business by means of automatic machines.—"Phot. Indus.," Nov. 6, 1912, p. 1551; "B.J.," Feb. 21, 1913, p. 133.

Positives Direct by Reversal with Thio-Urea.—G. A. Perley and A. Leighton have also made experiments on this process, and likewise conclude that the temperature must be kept constant (within 2° F.) in order to obtain uniform results. The results likewise vary according as more or less developer is used, and the quantity of developer should, therefore, be adjusted to the area of the plate.

By exposing a plate in a camera to an object illuminated by a Cooper Hewitt mercury arc light at a given distance, a positive was obtained after five minutes' development in the following solution, maintained at 12° C.:—0·0030 grams thiocarbamide, 0·0378 grams hydroquinone, 0·2837 grams soda sulphite, 0·0567 grams soda carbonate, and 12·7627 grams water per square inch of plate surface.

An excess of any constituent which favours an increase in the development of the latent image yields a partial negative (or a masked positive). An insufficient amount produces uniform development and a resultant fog.

An excess of thiocarbamide acts as a solvent for the emulsion. An insufficiency does not visibly affect the thin negative resulting from normal development.

No single constituent can be omitted from the above developer to obtain good results.

At 12° C. a small quantity of water (high concentration) causes the thiocarbamide to exert its solvent action. A large quantity of water (low concentration) retards the development of the latent image, with the production of a fog.

Under the same conditions as above at 18° C. an exceedingly good positive can be obtained on a lantern-slide plate with 0·0030 grams thiocarbamide, 0·0387 grams hydroquinone, 0·2907 grams sulphite, 0·075 grams carbonate, and 7·8461 grams water per square inch of plate surface.—"B.J.," Nov. 8, 1912, p. 860.

Positives Direct by Reversal with Thiourea.—F. C. Frary, R. W. Mitchell and R. E. Baker have described experiments on the working out of a practical and improved method of using the Waterhouse thiourea method of obtaining positives direct by reversal in development. They find that the temperature of the developer is the most important condition; also that the double salt of thiourea with ammonium bromide, or ammonium chloride, works better than thio-urea itself. The quantity of restrainer (bromide) varies with the compound used. A strongly alkaline hydroquinone developer is found to be the best, thio-urea solution being mixed with it as required. This process is found to yield positives of excellent detail, density and gradation, the exposures required being about double those necessary when making a negative by the ordinary method.

The hydroquinone formula recommended by Perley [Sol. A: water, 100, sodium sulphite (dry), 12.6, hydroquinone 2.1 gm.; Sol. B: water, 100, sodium carbonate (dry), 25.2 gm.] was the one which seemed to work best, and was used in most of the experiments. Satisfactory positives were also obtained with an adurol developer containing a rather large amount of alkali, but dianol and amidol were unsatisfactory. The effect of metol is very peculiar. A small amount of it added to the regular hydroquinone developer increases very much the density of the negative image which develops first, but acts as restrainer for the positive image. Hybrids generally result, although by decreasing the exposure very much and developing for a very short time, some rather poor positives could be obtained.

The tetra-thiourea-ammonium bromide, recommended by Waterhouse, but apparently not tried by Perley or other investigators, was very much superior to the simple thiourea, giving clearer and better positives. Most of the work was done with it. The corresponding chloride salt, however, appears to be better still, and works without a restrainer. The iodide was not very satisfactory. All these salts were prepared according to the directions of Reynolds. In the case of the thiourea or its compounds in the developer, the temperature may vary from 12 to 20 deg. C., but temperatures of 15 to 18 deg. C. (60 to 65 deg. F.) seem to give

the best results. Higher temperatures result in rapid development, *with production of fog; low* temperatures decrease the speed of development, and *especially the development of the positive.* At temperatures as *low* 7 deg. *C.* the negative *image could* be developed, but no positive image was obtained below about 11 deg. This effect of temperature seems to be independent of the effect of all the other variables

As indicated above, we obtain much better results by mixing the solution of the thiourea compound with the developer, in the proportion of 1 : 1, than by using it as a separate bath. In the latter case more trouble is found with fog, the results are more irregular, and tend to be spotted, the time of development and the difficulty of control are increased. Using the two solutions together, the development is much the same as the ordinary process, except that it takes less time.

The following procedure is recommended for the development of positives on the Cramer Banner X plate. The exposure is made in the ordinary way, and should be a little longer than for the production of a negative. Double the normal exposure will usually be about right. The hydroquinone developer recommended in a previous paragraph is used, mixing one part of A, one part of B, and two parts of a 1 : 1000 solution of either thiourea, tetra-thiourea-ammonium bromide or tetra-thiourea-ammonium chloride, preferably the latter. If thiourea is used, 0.5 cc. of 10 per cent. potassium bromide are added per 100 cc. developer; if the ammonium bromide compound be used, 2 cc. of the bromide solution per 100 cc. developer; while if the ammonium-chloride compound is used no restrainer is needed

Develop as usual, keeping temperature of developer between 15 and 18 deg. C.; the negative image first appears, then the plate appears to fog, and soon the positive image can be seen by transmitted light. Care must be taken not to over-develop, as the positive image will be quite strong. Rinse, fix, and wash as usual. If the negative image is too strong, it indicates over-exposure; the plate may be reduced slightly with the Farmer reducer. A foggy positive, with practically no negative, indicates under-exposure, if the temperature of the developer has been kept within the proper limits. Development is rapid, being usually complete within four minutes. The positive image is characterised by its colour; with the above conditions it will be red, warm sepia, or purplish red. The negative image is black and very transparent.

For making lantern-slides, the exposure will in general be less than that required to make a negative under the same conditions, and the developer should be diluted with an equal volume of water. If, however, the subject to be reproduced be a line-drawing, full strength developer and normal exposure may be used, followed by slight reduction. This will give excellent contrast. In fact the principal fault of the process from the viewpoint of the slide-maker is the large amount of contrast obtained; the range from high-light to shadow is as great as in a good negative, consequently the slides of scenes tend to be too heavy in the shadows. This

defect is minimised if an ordinary plate is used instead of a lantern-slide plate.

The process works well with the Lumière Autochrome plate, using the normal developer diluted with an equal amount of water, but the strong red colour of the image spoils the colour rendering, *so until this colour can be modified the process does not seem to* be applicable to this plate.—"B.J.," Nov. 1, 1912, p. 840.

Double-Coated Printing Paper.—Patent protection has been obtained by W. C. Renfrow and F. G. Wilcox for a printing paper having a sensitive emulsion on each side of the raw paper stock. This latter is of thin substance, and is rendered non-actinic by a suitable dye. The object of the paper is for preparing thin sheets having a photographic print on each side.—Eng. Pat. No. 2,675, 1913; "B.J.," Sept. 26, 1913, p. 750.

Gelatine and Collodion P.O.P.

GELATINE P.O.P.

P.O.P. Emulsion.—A. Coblenzl has given working formulæ for the making of P.O.P emulsion for positive printing.—Eder's "Jahrbuch," 1911, p. 119; "B.J.," Sept. 12, 1913, p. 705.

Sulphide Toning of P.O.P.—H. S. Swain gives the following working directions for the toning of P.O.P. prints with ammonium hydrosulphide. The P.O.P. must be printed considerably deeper than for gold toning. Prints are fixed by immersing, one by one, in hypo bath of strength 1 : 10. It is necessary (for this method) to use a somewhat stronger solution than usual. The prints having been thoroughly fixed prior to toning, the results depend chiefly upon a thorough washing after fixation. Apparently a startling change takes place here, inasmuch as the prints become slightly reduced. However, the prints being fixed and well washed, place them singly into the toning bath made up proportionately as follows :—

Distilled water	12 ozs.
Hydrosulphide of ammonium	3 drops.

This is an amount insufficient to colour the water. The prints in this will then gradually change from chestnut brown, and proceed to purple. Don't keep them too long in the toning bath, as the prints dry up much darker than they appear. After they leave this bath, place them in running water for half an hour. They are now ready for mounting or glazing, the process being much more rapid than one can describe.

Too strong toning bath ruins the quality of the prints.

Prints are rich in tone; they are permanent, being produced in true sulphide of silver. The working cost is insignificant, therefore uncertain results or failures are unnecessary. Do not use stale paper or card; it cannot be expected to get decent tones if material is old or faded. Should the tone of prints be at all faulty it is

owing to insufficient washing after fixing. With traces of hypo in the toning bath reduction takes place. Between the two baths a normal formaline hardening solution is an advantage for use in warm weather, and in practice does not prolong the operations.—"B.J.," May 9, 1913, p. 370.

Restoring Faded Prints.—W. Binfield gives the following procedure for restoring faded silver prints. The first essential is to soak the print in potash alum solution (½ oz. to 20 ozs. water) for three or four hours to destroy hypo and harden the surface of the print. After well washing, the print is bleached in a solution of mercury bichloride-saturated solution of this salt mixed with an equal bulk of 1 : 50 hydrochloric acid. In this the print is left, with occasional rocking, to bleach as far as it will. It is then washed in six to eight changes of 1 : 50 hydrochloric acid, then in three or four changes of water, after which it is ready for darkening. For this the best mixture is :—

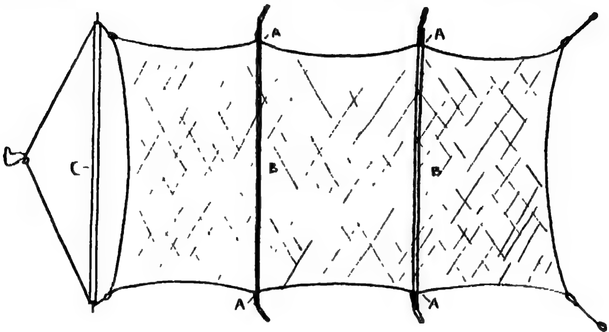
Metol	45 grs.
Sodium sulphite (crystals)	130 grs.
Sodium carbonate (crystals)	270 grs.
Water to	10 ozs.

Placed in this solution, the print ought to darken very rapidly, and when it has done so all that is needed is a further washing in six or eight changes, when it may be put up to dry. The whole of the operations may be carried out in daylight, and on no account should any attempt be made to curtail any of them, such as by omitting any of the washing, the extent mentioned above should be regarded as sufficient, but as the minimum.—"Phot.," June 24, 1913, p. 512.

Washing Prints.—L. Wendell recommends the convenience of washing prints by suspending them, by cork clips, in an ordinary bath, which is allowed to remain filled with water to the level of the overflow, circulation of water being produced by letting the tap run into the bath. In the case of a bath which has no outlet (overflow) in the upper part it is a simple matter to fit a pipe of galvanised iron into the outlet hole in the bottom of the bath. The upper end of this pipe should be slit at five or six places and bent outwards, as shown in the drawing. If this is not done the pipe is liable to choke by a print being sucked down on its upper flat end. With a flaring mouth the water always drains before reaching the top of the pipe, and hence there is no danger of obstructing the outlet or of breaking the surface of prints.—"Photo-Era," Aug., 1913, p. 70.

Hammock for Drying Prints.—A. W. H. Weston describes a convenient portable arrangement for the drying of prints in any room which is fairly well warmed and ventilated. He uses it in a studio which is heated by an anthracite stove burning continuously

day and night. It can be rolled up and put away in a corner when not in use; and the net may very easily be detached for washing. The hammock is stretched across the whole width of the studio. To attach the cross rods, loops of tape are firmly sewn to the four corners of the net, and at A, A, A, A four short lengths of tape are sewn to the edges. The tapes A, A, A, A are stretched tight and fixed with drawing-pins to the end of the cross rods B, B, and the corners are looped to cords which attach them to the rod C and to two hooks in the studio wall. It will be seen that this arrangement allows of very easy detachment for washing.



The net is made of cheesecloth, and, being suspended in mid-air, the prints dry from both sides. Certain papers may be dried on the cheesecloth face downwards, and this, of course, lessens their tendency to curl.—" B.J.," Aug. 15, 1913, p. 632.

COLLODION P.O.P.

Collodio-Chloride Emulsion.—A. Coblenzl has given working formulæ for the making of collodio-chloride emulsion for positive printing.—Eder's "Jahrbuch," 1911, p. 119; "B.J., Sept. 12, 1913, p. 705.

Platinum Toning.—MM. Lumière and Seyewetz have recently made experiments with a view to discovering the completeness with which the toning with an acid platinum bath takes place. They used a bath consisting of the following :—

Water	1,000 c.c.s.
Metallic platinum in form of chloroplatinite	0·45 gm.
Sulphuric acid, 10 per cent. solution	50 c.c.s.

and found that :—

(1) The effect of acids in the toning of prints with platinum appears to be due to ionisation of the chloroplatinite, which takes place more readily in an acid than in a neutral vehicle.

(2) The exhaustion of the toning baths with chloroplatinite repre-

sents the use of about 90 per cent. of the platinum—a much higher efficiency than in the case of gold toning.

(3) The prints toned with platinum contain a fairly large proportion of silver (from 25 to 30 per cent. of the original silver). This proportion is considerably less than in the case of prints toned with gold.—" B.J.," Feb. 28, 1913, p. 159.

The Best Platinum Baths.—A. and L. Lumière and A. Seyewetz have made experiments with a view to discovering the best acids for the platinum toning bath as regards colour of the print and keeping qualities of the bath.

They find that as regards the keeping qualities of the toning baths containing chloroplatinite and an acid, the following acids allow of baths which keep quite satisfactorily :—Sulphuric acid, hydrochloric acid, nitric acid, phosphoric acid, and lactic acid. The baths keep equally well in the light and dark. On the other hand, baths composed of boric acid, acetic acid, oxalic acid, tartaric acid, and certain substitutes for acids, such as resorcin, alter more or less rapidly. Finally, formic acid causes a complete reduction of the platinum within a very short time.

As regards the quality of the prints made with the respective baths, there is no appreciable difference between those containing the acids—sulphuric, nitric, phosphoric, citric, and lactic. All these give good black tones and pure whites.

In contradiction to the statements of some writers, there appears to be no advantage in using organic acid in preference to those of mineral origin, though the former do assist the reduction of the platinum salt. In practice, it appears wise to select sulphuric acid instead of phosphoric acid on account of the ease with which sulphuric acid is obtained of definite strength : in the case of phosphoric acid there is often some doubt as to its strength.—" B.J.," Dec. 27, 1912, p. 992.

Bromide and Gaslight Papers.

BROMIDE PAPERS.

Bromide Emulsion.—A. Coblenzl has given working formulæ for the making of bromide emulsion for positive printing.—Eder's "Jahrbuch," 1911, p. 119; "B.J.," Sept. 12, 1913, p. 705.

Six-On Bromide Printing Machine.—R. J. Sutton has described an apparatus for rapid bromide printing, six exposures from the one negative per sheet, on the lines of that detailed by "Teetotaler" ("B.J.A.," 1913, p. 643). A sliding gripper guide is used in the machine. DD is this guide, and it slides on the half-round beading EE. When the guide (which works fairly stiffly under retaining beading F) is pushed up to K, as shown in diagram, the lower half of the sheet is printed, first, by the gripper being held in close contact with the blocks G1, then lifted over and held against G2, then close up to the negative against the block G3; then the slide is pulled down by right hand till stopped by stops Gg, then pressure bar prints No. 4 at stop G3, and so on back to G1.

The slide stops Gg are hinged to fall back, so that the slide can be pulled back to the contact L to allow the negative to be changed;

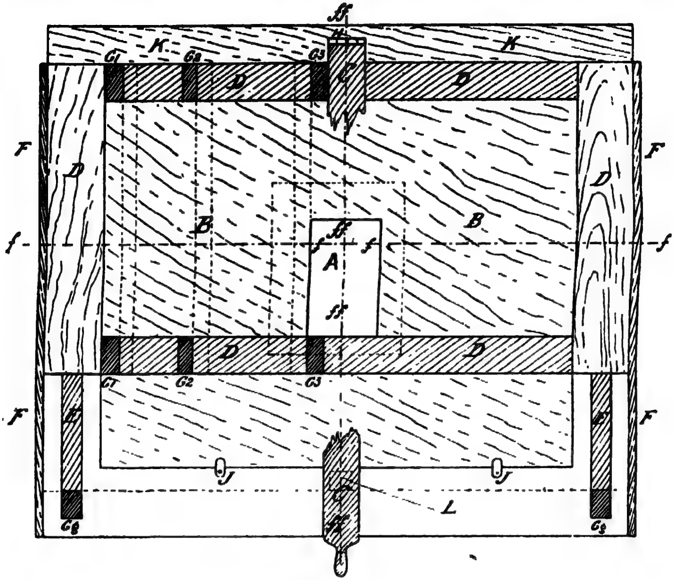


Fig. 1.

A. Mask opening. B. Cardboard mask. C. Pressure bar. D. Gripper guide. E. Guide slide. F. Retaining slide. H. Hinge. J. Turnbuttons. K. Batten. L. Contact to white light. Gg Slide stop.

the turnbuttons JJ being slipped back, the mask B can be lifted inside the guide sufficiently to allow the negative to be changed.

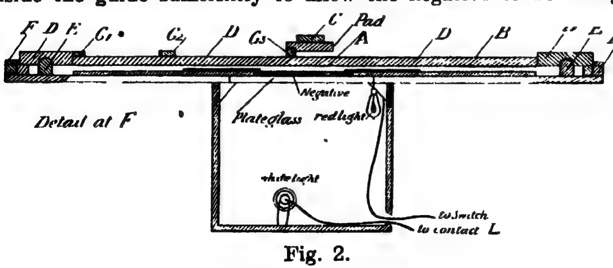


Fig. 2.

Section on line *ff*.

This sounds rather slow work, but, as a matter of fact, it is done very quickly.

The time saved in printing is only a minor detail of the process; the beauty of it lies in the ease of manipulation in the after processes, *i.e.*, developing, washing, toning, and drying, and in some cases 50 per cent. of the time formerly needed for these operations

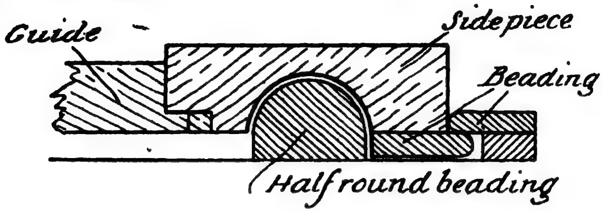


Fig. 3.
Detail of slide.

has been saved, notably perhaps in trimming, whereas nine cuts are only necessary (if registration is correct) for six cards, as against twenty-four formerly.

After drying, a great improvement is made in the finished results if they are put one by one, before trimming, under the dry-mounting

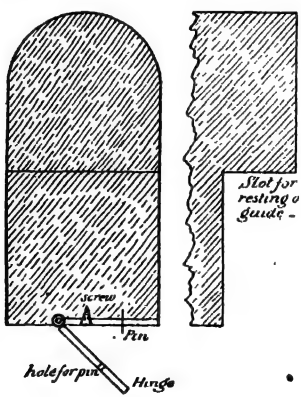


Fig. 4.
Detail of piano hinge gripper.

press, heated to about 160 degrees F. Hardening is a necessity with most emulsions; add about ½ oz. of formalin to the last washing water to prevent the cards being too soft for fair handling.

The gripper is certainly an unfortunate necessity, but with practice its use is soon mastered. Some fine holes are bored right through a piano hinge, one at each end and one in the middle, and broken

needle points fixed into the wood (after fixing to the holder) through these holes. This grips the card perfectly.

The two lights (red and white) are wired to a two-way switch wired in the usual way, the only break being at contact L.

Another and important point is the necessity, by "Teetotaler's" method, of having half the card backs printed one way and the other half the other (that is, of course, with horizontal subjects), otherwise half the cards will be printed upside down: the present apparatus is an improvement in this respect.—"B.J.," July 11, 1913, p. 532.

Warm-Tone Developers.—R. Fischer has patented the addition to developers of a substance capable of combining with the oxidation product of the developer to form a sparingly soluble, coloured substance. For example, the developing agent may consist of *p* phenylene-diamine or its homologues or derivatives, and phenol, naphthols, or their derivatives may be added to the developer. Again, using a *p*-diamine- or *p*-aminophenol or a derivative as developer, an aliphatic or aromatic methylene compound of acidic character may be added to the solution. Variations of these examples can be made to give images of a large variety of tones. The phenol, amine, or methylene, or the leuco-dyestuff (indophenol, azomethine compound, etc.) may be used as the developing agent. Ger. Pat. 253,335 (Feb. 7, 1912).—"B.J.," Jan. 24, 1913, p. 73.

Acid Amidol Developer.—Sir W. N. Hartley has worked out a modified formula of the Balagny acid amidol developer for bromide papers, with which it gives a rich black image of full contrast and pure whites. The formula is:—

Water	150 c.c.s.	5¼ ozs.
Amidol	1 gm.	15 grs.
Sodium sulphite (powder) anhydrous	2 gms.	30 grs.
Potassium bromide solution, 10 per cent.	5 c.c.s	85 minims.
Sodium bisulphite solution	10 c.c.s.	5 drams.

Here potassium bromide has been substituted for the ammonium salt: though it is less active than the latter, the amidol requires less restraining than the diamidophenol base. Printing by gas-light, diffused day-light, or in an enlarging camera, is followed by development, when the photograph appears gradually with strong contrast in a rich black and pure white, with a correct rendering of intermediate values when the exposure has been correct. When the developer is poured over the surface of the print air bubbles are removed by a soft brush, a piece of clean white blotting paper, or even with the finger moistened with water. The acid solution does not stain the fingers.

Fix (after washing) in an acid bath, such as the following:—

Water	1,000 c.c.s.	20 ozs.
Hypo	250 gms.	5 ozs.
Sodium bisulphite (solution)	20 c.c.s.	3 drams.

Acid development can be adapted to photography with plates, films, and papers, and is to be preferred for landscape work.—"B.J.," March 21, 1913, p. 225.

Stress Marks on Bromide.—R. H. Dawes Lamb recommends the addition to the bromide developer of 10 per cent. potass. cyanide solution in the proportion of 40 to 60 minims per 10 ozs. of developer. This has been found a certain preventive of stress marks on the prints, yielding clean bromides, and being without effect on the colour of the print.—"B.J.," Nov. 22, 1912, p. 909.

R. Sammes gives as his experience in the commercial handling of bromide papers the following as the chief causes of markings on bromide prints:—

(1) Cut paper in gross boxes gets marked when taking the sheets singly from the box. This can be avoided by cutting a thumbhole in one end of the box and lifting the sheets instead of scraping them.

(2) Scratched on the negative.—A varnished negative will reduce the possibility of this occurring, but a dusting brush must be used and the paper must be lifted, *not drawn,* from the printing frame.

(3) Marks on borders when using a shield.—Have new shields regularly and destroy the old ones. The surface of the board gets bruised, dust gets embedded in it, and the whole shield becomes furrowed and ridged. Then the paper, after being scraped into position and exposed, is scraped off again with its surface badly damaged.

(4) Marked in development.—Very few workers consider the advisability of filtering or decanting a developer. Sulphite of soda is particularly treacherous, and accounts for many stress marks. Insoluble bodies included with this soda float about in the developer and scratch the paper each time they pass across its surface. Old developer, too, is to be avoided or decanted. All practical workers will recognise the danger of using carelessly "a drop of old." The trouble lies in a sediment which rocks to and fro between the developer and the surface of the paper. This collection of filth, being heavier than the solution, simply grinds its own image into the yielding gelatine.

(5) Marked by paper knife.—Sometimes it is necessary to cut up paper, and the surface becomes badly mauled. But if two sheets are cut face to face, or one sheet folded so that the surface is protected, the process is safe, and no abrasions can result.—"B.J.," Dec. 6, 1912, p. 946.

Removing Stress Marks.—G. R. Henderson recommends the following solution for removing stress and other dirty markings on bromide prints:—

Borax	½ oz.
Boiling water	20 ozs.
Meth. spirit	5 ozs.

This is applied to the print with a tuft of cottonwool, and will in every case remove all traces of stress markings and dirt and leave

a beautiful natural surface on the print. This procedure is especially useful when dealing with the "sketch" style of picture, the print being first rough mounted, then cleaned as above, and finally cut to size.—"B.J.," Nov. 1, 1912, p. 849.

Improving Weak Bromides.—J. Goulding recommends the use of an iodide bleacher, followed by darkening with sodium hydrosulphite, for the improvement of prints which require a little intensification to remedy defects of depth or colour.

The first step is to bleach the plate or print with an iodide bleacher. Probably the most convenient form is to take equal parts of 10 per cent. solutions of potassium iodide and potassium ferricyanide, diluting the mixture with, say, from 1 to 3 parts of water. Of course, starch-sized papers will turn violet at this stage of the process. Whether for plates or paper, it is desirable that the action of the iodising solution should be complete. A brief wash should be followed by the application of a potassium metabisulphite solution or of the cheap and handy sodium bisulphite lye (diluted, say, 1 to 8 or 10—the strength is not very material). This will quickly remove any iodine stain, and the image will now be much whiter in appearance, and ready for re-development.

The iodide image is very stable compared with one bleached by bromide or chloride solutions. Ordinary developers are without effect in the absence of exposure to light. If anyone trying the method will treat the plate or print with any clean working developer (amidol, metol, rodinal, etc.) in bright daylight—sunlight for choice—the result will usually be a purple-toned image, pleasing in colour and considerably stronger than the original.

But it would appear that an image re-developed with an ordinary developer, as above, is capable of still further reduction, using the word in the chemical sense, by the application of a more powerful reagent.

Sodium hydrosulphite, which is used on the large scale in the dyeing industry, and is obtainable under its name as above, and also under various fancy trade names, has been used by the writer. This salt is now produced in the anhydrous form, and a freshly prepared solution of, say, 30 grains to the ounce is effective.

Applied to the bleached image (or, equally, to an image re-developed by an ordinary developer) in bright light, the result is, in all the plates tried by the writer, a pure black image, brightened and somewhat intensified, and, obviously, no source of impermanence has been introduced. Probably the amount of intensification may depend upon the make of plate and also upon the extent of the original development.

In the case of prints the colour varies considerably in different papers. In some makes it is pure black; in others a rich brown; always stronger than the first state of the print. The process is, perhaps, most effective in the case of a weak gaslight print—the kind that would be quite unsuitable for sulphide toning.—"B.J.," July 25, 1913, p. 576.

GASLIGHT PAPERS.

***Gaslight Emulsion.*—A. Coblenzl has given working formulæ for the making of gaslight emulsion for positive printing.—Elder's "Jahrbuch," 1911, p. 119; "B.J.," Sept. 12, 1913, p. 705.**

Purple Tones on Gaslight Paper.—F. Warrington recommends the use of a bleacher, made as below, for producing purple tones. The bromide print is made in the usual way, fixed and washed and bleached in :—

Potassium ferricyanide	10 grs.
Potassium bromide	10 grs.
Water	1 oz.

When fully bleached the print is washed for three or four minutes in running water and then exposed to daylight as above described. The P.O.P. tone seems permanent, and the depth the print finally possesses is the same as it originally had before toning.

Similar purple tones are obtained by printing-out the paper, like P.O.P., by exposure to daylight under the negative. A very long exposure (three hours or more) is required, after which the print is simply fixed in a plain hypo bath.

The results described above were obtained with Wellington "S.C.P." paper.—"Phot.," Oct. 29, 1912.

Developing "Professional" Cyko Paper.—W. Foster Brigham has described the methods used by himself in treating the special "Professional" grade of "Cyko" paper, emphasising the tremendous quantity of bromide which can be used without yielding harsh prints, but serving only to modify the colour of the print. A suitable developer is :—

Water	80 ozs.
Metol	2 drs.
Soda sulphite, cryst	8 ozs.
Hydroquinone	1 oz.
Soda carbonate, cryst	11 ozs.
Potass. bromide	3 ozs.

(Or saturated solution of bromide may be added to taste.)

For use, take 5 ozs. of the above stock solution to 15 ozs. of water.

With, say, half an ounce of bromide instead of three, the image is a fine steel grey. With a medium quantity the colour is olive black, whilst the above formula, as printed, gives a fine, warm, brown-black. At the start, begin with a little bromide, and try the effect of adding saturated solution of bromide until the colour desired is obtained. Do not be afraid of the bromide bottle.

The developer should be used between 65 deg. and 75 deg., and in cold weather it is essential, as, indeed, it is with all developing papers, to have an easy method of keeping the developer at that heat; a cold bath gives a greyer colour and contrasty prints without detail in the highest light.

Cyko paper has the advantage of not flashing up, but building up gradually, giving ample time to decide on the exact depth before

removing to fixer; in fact, in a well-exposed print there is a perceptible pause in the shadows whilst the high-lights build up. The perfect print will be just right in depth after being in the developer between one and a-half to two minutes; if left in the developer, it would go on until almost black all over. A fuller exposure will give a print very slightly flatter and warmer in tone—that is, dark enough in less than the ideal time; if removed quickly, the resulting print will be quite good, and, in fact, over-exposure is not very apparent until the print develops up granularly.

One can over-expose up to ten times and get a rather effective print, not flat, muddy, and dark, but with a not unpleasing half-tone effect. Slight over-exposure is, indeed, preferable to under-exposure, unless the negative is a thin flat one with transparent high-lights. Under-exposure, even up to requiring ten minutes for development, will improve such negatives with a much colder toned print. From negatives of normal density in the high-lights, however, any under-exposure will not give those fine delicate details with transparent shadows that are distinctive of the paper. In fact, to make the most of every gradation in the negative, expose to develop in one and a-half minutes in developer at 65 deg.; this gives the wonderful skin texture and fleshy bloom seen in all good Cyko prints. After developing, prints may be rinsed and put straight into hypo, or placed in a stop bath of glacial acetic acid, ½ oz., with water 80 ozs., afterwards being fixed for fifteen minutes in hypo 2 lbs., water 120 ozs., acid-alum solution 10 ozs. This latter is made as follows:—

Sodium sulphite	1 lb.
Water	80 ozs.
Glacial acetic acid	6 ozs.
Powdered alum	½ lb.

First dissolve the sulphite in a portion of the water, allow to cool, and then add very slowly the acetic acid, stirring the while; dissolve the alum in balance of water and add to sulphite and acid. A freshly made fixer, if allowed to act too long, may slightly attack the fine high-lights; therefore, time for fifteen minutes, afterwards washing thoroughly, taking particular care with double-weight paper.

Carefully used, the hypo-alum gives unequalled results, yielding the same tones always. For "liver-of-sulphur" toning, a suitable formula is:—

Liver of sulphur	1 dr.
Water	120 ozs.
Ammonia	2 drs.

The action takes place at 100 deg. in two or three minutes. The colour obtained by toning right out is a very fine one. Note that the quantity of "liver of sulphur" is most minute, much smaller than the normal formula. Do not use any stronger, however, as the only result is to save a few seconds in toning at the expense of degrading the snow-whiteness of the paper stock. Use the solution

in a porcelain dish. If there are only a few prints to tone, make the solution up with hot water: there is no reason to heat further. With a batch of prints, however, the dish should be kept on a water bath. The solution may be allowed to go higher than 100 deg., and will have no effect on the tough Cyko emulsion. After toning, drain and soak out for a few moments in a first wash of hot water. This avoids yellowing the whites. Avoid working out the bath, as this leads to colder tones. The above formula will tone fifty whole-plates masked out on 10 x 14 paper.

The chief beauty of this method, after, of course, the speed with which a rich brown is secured, is that all the tones between warm black and ruddy brown are tones almost free from double toning. If prints are removed too soon from hypo-alum the deep shadows are black whilst the high-lights are brown; with this process this is not so, the colour being all over alike. If a nicely developed, warm-black Cyko is just rinsed through the bath, the result is a still warmer black, very pleasing, and achieved photographically by no other means. A little longer gives a curious tone, also new to photography, and one, therefore, that can scarcely be described. The flesh tones in a portrait take on a rich, warm tone, marred a little by its being somewhat pinky. The next stage is a cold brown, next a rich brown, followed in special circumstances by a beautiful ruddy brown. The resulting colour depends, as usual, upon the preliminary development. A black print developed for the ideal time gives the perfect sepia. Prolonged development gives a colder brown when toned right out, and so does the above bath, worked until the yellow colour begins to disappear. To obtain the ruddy brown, give the black print one and a-half times to twice the ideal exposure, plucking out of the developer when the least shade darker than you would like for a black print.—"B.J.," May 2, 1913, p. 342.

Toning Bromide and Gaslight Prints.

SULPHIDE TONING.

Developer for Sulphide Toning.—N. C. Deck has published experiments showing the effect of bromide in the developer on the final prints when the sulphide toning method is used. If bromide of potassium is added to the fresh developer in fairly large quantities, and the prints are developed fully, the resulting sepia tones will be found to be much colder than normal, and not warmer than those produced on prints developed to the limit with normal developer only slightly restrained. In fact, with the latter, directly development is stopped short of the limit, there is a change in the direction of yellow sepias on toning. With the heavily restrained developer (formula given below) this is not so, and unless development is stopped very early, the resulting sepias will always be good, although they vary, of course, with the length of development. Moreover, the black and white prints before toning are likewise of good quality. The main point to be insisted upon is, always to use fresh developer.

NORMAL DEVELOPER.

Amidol	2 grs.
Soda sulphite cryst	20 ,,
Potass. bromide 10 per cent.	2 mins.
Water	1 oz.

RESTRAINED DEVELOPER.

Amidol	5 grs.
Soda sulphite cryst.	20 ,,
Potass. bromide 10 per cent.	50 mins.
Water	1 oz.

The proportions of the developer are important, for it must be remembered that sodium sulphite is a weak alkali, while amidol is acid, and when it is added to the sulphite solution there is an interaction which can easily be detected by the odour of sulphurous acid given off. In the second formula the proportion of amidol to sulphite is much increased, that is to say, the developer is less alkaline; it is then more amenable to the action of potass. bromide, which then gives the latitude mentioned above, for if added in like quantity to the first formula, it slows development rather than exercising a restraining action.—"Harrington's Phot. Journ.," May, 1913, p. 151. "B.J.," July 18, 1913, p. 549.

Permanganate Bleach Process.—T. H. Greenall has worked out the following method of obtaining very rich sepia brown tones by the use of a permanganate bleaching bath. An advantage of the method is that prints may be placed into the bleacher with only a brief rinse in water. There is scarcely any difference in the results as compared with those obtained after washing out the hypo, but more permanagante bath is used in toning the prints. The formulæ are as follows :—

STOCK SOLUTION A.

Potassium permanganate	40 grs.
Water	20 ozs.

STOCK SOLUTION B.

Strong hydrochloric acid, B.P. 31.8 p.c.	3 ozs.
Water to make	20 ozs.

For use take 6 ozs. of water, add 1 oz. of B, and then add 1 oz. of A. The total makes 8 ozs. of working mixture, which should bleach a normal print in about one minute. A stronger solution may be used in which the quantities of A and B are double those given. Both stock solutions keep indefinitely in stoppered bottles, but the working mixture must be made up at the time of using, as it will not keep, and must be discarded as soon as it shows signs of discoloration and muddiness. As, however, it is very cheap, costing less than one farthing a pint, this is no drawback.

An alternative formula which acts equally well, and costs only about one-tenth of a penny a pint, is as follows :—

Common salt	80 grs.
Stock solution A	1 oz.
Sulphuric acid (commercial)	20 mins.
Water to make	8 ozs.

The salt and sulphuric acid should be kept separately in solutions, and the ingredients brought together at the time of using, care being taken to secure proper mixing by pouring the solution from one vessel to another and back. If dry prints are taken they should be soaked in water before bleaching.

The image usually disappears entirely, unless an excess of A solution has ben employed, in which case a brown image is formed. If the quantity of working mixture taken is insufficient to complete the bleaching it is best to throw it away and take a fresh, slightly stronger portion. Any pink tinge or brown discoloration may be neglected, as it will disappear in the sulphide of soda by the time the image is properly sulphided, and it is not necessary or advisable to wash between bleaching and sulphiding, but should there be any final brown tinge left in the paper after sulphiding, the prints may be rapidly cleared by placing them without washing in a solution of oxalic acid (1 per cent.) to which a few crystals of sulphite of soda have been added. Experiments with varied classes of prints, weak and strong, show that with permanganate used as above the best possible result may be relied on from any given print, provided, of course, the sulphide solution is not stale and has been made from clean, dry crystal sulphide. A grain of sulphide to the ounce of water is strong enough for the working bath.

An advantage, however, of this permanganate bleacher, of enormous value in special cases, is that prints may be put *straight from the hypo* into the acidified permanganate solution after a slight rinse in one or two changes of water, the only difference being that more of the permanganate solution will be required. Thus, if 8 ozs. of the working mixture is sufficient for a given 12 × 10 print, which has been washed, say, 5 or 10 minutes in frequent changes, 50 or 60 ozs. might be required for the same print if taken practically full of hypo. In practice, a few minutes' washing would always be given if possible, and this makes a print in all respects as workable as one which has been washed the usual hour in running water. Trials have been made with both acid hypo and plain hypo, and in no case is there any loss of detail or vigour, whilst the colours obtained are identical, whether the print is taken straight from the hypo or given an intermediate washing of one or two hours duration. The method of working a print which contains hypo is to treat it with the acidified permanganate working mixture as above in successive portions. The first portion will probably quickly lose colour as it acts on the hypo. It must be discarded and a fresh portion used. If much hypo is present the stronger permanganate bath may be used. A minute or two should suffice to eliminate the hypo and bleach the print, when it may be at once put in the sulphiding bath. The only danger of failure appears to be that of oxidation of any brown stain due to exposure to the air, but so far there has not been any trouble in getting clean prints with pure whites, except when the strength of A or permanganate solution was overdone.—"B.J.," March 14, 1913, p. 191.

In some further notes on the above process T. H. Greenall gives the formula for an alternative bleacher, with which it is easy to

secure intermediate tones as well as satisfactory results from prints which are somewhat weak for sulphide toning. The most suitable strength to employ for this purpose appears to be as follows :—

Common salt	40 grs.
Permanganate of potash solution (2 grs. to the oz.)	4 drachms
Sulphuric acid (commercial)	10 mins.
Water to make	8 ozs.

The ingredients are to be kept in separate solutions and mixed at the time of using. As the action is very rapid it is important to take all precautions to flood the print evenly and keep the dish moving. It is also very important that the bromide print be thoroughly and uniformly wet before flooding with the permanganate. The time required in the permanganate in order to obtain any given tone will depend partly on the character of the print, but it may be taken that a print would tone to warm black if bleached for one-eighth the time required to bleach a similar print completely out in the same solution. Thus a print which would bleach entirely in 1½ minutes would tone to a warm black if treated with the permanganate for about 10 seconds only before sulphiding. A similar print treated for 20 or 30 seconds would tone to a brown. It is hardly possible to notice the action of the permanganate on a print immersed for 10 seconds until it has been sulphided, but prints treated for 20 or 30 seconds will appear as though partially reduced. In a fully bleached print the image disappears entirely.

On removal from the permanganate solution prints must be put straight into the sulphide of soda solution, which instantly destroys any permanganate in the print and at the same time sulphides the image, or they may be quickly and thoroughly rinsed and put under water until later. They must not be put in any clearing solution until after they have been sulphided, but should any brown tinge remain in the paper after sulphiding they may be given a bath of 1 per cent. solution of oxalic acid containing a little sulphide of soda to whiten them. It will be found that as the prints dry the tones will become colder, and prints which are rather weak for sepia toning are more satisfactory in one of the intermediate tones. In fact, the tone obtained by stopping the bleaching just before the image disappears entirely is usually the most satisfactory, and differs but slightly from the final tone. The warm black tone is also a most useful one for a large number of subjects, and is obtained with the greatest ease, provided the action of the permanganate is limited to 10 seconds.

Although this is not the only bleaching solution which may be used for the purpose of obtaining intermediate tones, its advantages lie in its extreme cheapness, and in the fact that having to be used fresh for each print its action will be always constant, provided the solutions are accurately compounded.

The use of permanganate as a combined hypo eliminator and bleacher for sulphide toning refers to the full and complete process.

When partial bleaching only is desired it is obvious that hypo-free prints should be employed.—" B.J.," May 2, 1913, p. 341.

Improving Sulphide-toned Bromides.—In the case of prints which, after toning, are muddy, or have a yellowish tint over the high-lights, the following method, given by T. Ribbans, effects an improvement:—After toning with the sulphide, immerse the prints in a weak solution of iodine in iodide, afterwards putting them straight into the hypo bath to clear away the blue stain. The prints are then well washed. In the case of prints toned with hypo-alum it is necessary to wash well before and after iodising.—" B.J.," Feb. 28, 1913, p. 163.

Re-toning Sulphide-toned Prints.—F. Winning recommends the following process for the after-treatment of sulphide-toned prints which may require improvement in respect to either colour or depth. Make up a mercuric bromide solution as for intensifying plates:—

Mercuric chloride	100 grs.
Potass. bromide	100 grs.
Water	10 ozs.

The sulphided print is placed in the above, and for some time, perhaps about fifteen minutes, no apparent change takes place, after which it gradually bleaches to a greenish yellow colour. Wash, and then pass through three baths of weak hydrochloric acid. Wash, and then re-develop in any clean working developer. The final result will depend on a variety of circumstances (the exposure, the first development, the time left in the mercury, etc.). Although the print, when put in the mercury solution, shows little or no change, the mercury is acting, and if the print is taken out in five minutes and re-developed the result will be a cold brown colour and slight intensification. The longer in the mercury solution the colder the final result and the greater the intensification. With some papers it is found that olive green tones are got after the mercury development. The only way is to try it and find what length of time is required in the mercury bath to give the final result required. If a very pale foxy sulphided print is produced, and is then bleached in the mercury and then re-developed, a very fine rich black is produced. Prints made five years ago by the above process have shown no sign of fading.—" B.J.," Dec. 20, 1912, p. 986.

" Beegee " advises the following method:—The sulphide-toned prints are bleached in the dark-room by means of a bath made as follows:—

Copper bromide	130 grs.
Sodium bromide	2½ ozs.
Water, up to	10 ozs.

When bleached, the prints are rinsed thoroughly, and should be then taken into daylight, after which they may be re-developed in any non-staining developer, metol-hydroquinone or amidol without

bromide being most suitable. This requires no fixing. The print may now be re-toned by any usual method.—"B.J.," Dec. 20, 1912, p. 986.

Blue Stains on Sulphide-toned Prints.—These blue stains, which usually do not show until prints have been treated in the sulphide bath, can be removed as a rule by the following method given by "C. F. G." The print should be laid in a large, dry dish, and the stain carefully wiped over with a piece of clean wadding well charged with hydrochloric acid, which must be concentrated—dilute is of no use. Gradually the stain changes from blue to a brownish yellow; immediately this happens the print should be flooded with water to remove the acid, which, if allowed to remain, would damage the print. The yellow stain will gradually dissolve out in the final washing.—"B.J.," Apr. 18, 1913, p. 309.

Mercury-Sulphide Toning.—"Toner" recommends a method of bleaching the print in mercuric iodide, afterwards darkening in barium sulphide solution. The print should be very slightly under-exposed and then developed and fixed in the usual way. After washing it is intensified with mercuric iodide, leaving it in this bath for from a half to two minutes, according to the degree of intensification required, though at this point the intensification cannot be seen, the print merely becoming a brownish black. It is again washed, passed through a bath of dilute hydrochloric acid (acid 1 part, water 100 parts), washed again for five or ten minutes, and then placed in a saturated solution of barium sulphide. This is made by putting about five grains of the sulphide into four ounces of water, stirring well, leaving the liquid for a few minutes for the undissolved sulphide to settle, and then pouring off the clear liquid. It is well to rinse out the measure directly the clear liquid has been poured off, but should the sediment form a hard crust it can easily be got off by pouring on to it a very little pure hydrochloric acid.—"Phot.," July 1, 1913, p. 17.

Sulphide-Ferrocyanide Toning.—H. M. Ward has patented a process in which the tone is obtained by a combination of copper-ferrocyanide and silver-sulphide. A print or transparency is toned with copper, the image being partly or fully converted to copper ferrocyanide. It is then treated with any of the various bleaching solutions, or a similar result may be produced by adding a bromide, chloride, or iodide salt to the copper toning solution. A chromate bleaching solution may also be combined with the copper bath.

The print is now sulphided by any of the various methods.

It is now treated with a ferricyanide, to which may be added any suitable solvent of silver. As an example:—50 grains potassium ferricyanide, 50 grains ammonium sulphocyanide, water 10 ounces. A bromide, iodide, or chloride salt may be added to the ferricyanide solution, as also ammonia or other alkali. The print may now be passed through a bath of hypo and well washed.—Eng. Pat. No. 8,002, 1912; "B.J.," May 9, 1913, p. 366.

SINGLE-SOLUTION SULPHIDE TONING.

Single-Solution Sulphide Toning.—E. Fenske has patented the following method of toning bromide and gaslight prints to various shades of sepia in one solution used at a normal temperature, 60 deg. F. For this purpose 120 grains of sulphurated potash (liver of sulphur) are dissolved in 15 ozs. of water; to this is added one fluid ounce of a saturated solution of hyposulphite of soda. By adding four more ounces of water this solution is made up to 20 ozs. This solution is filtered and the clear solution forms the toning bath, in which the bromide or gaslight prints, plates, or films may be immersed, directly they leave the fixing bath, being only given a slight rinse, and in which they remain until they attain the desired tone, when they are withdrawn and washed in the usual manner until freed from the chemicals.—Eng. Pat. No. 18,545, 1912; "B.J.," Aug. 29, 1913, p. 674.

Cold Sepia-Toning by Colloid Sulphur.—A. and L. Lumière and A. Seyewetz have described a method of producing sepia tones on bromides. The prints are immersed in a mixture which generates sulphur in the colloid state. No toning action is apparent at this stage, but on washing for about twenty minutes in water the prints gradually assume a sepia tone.

The colloid sulphur is produced by mixing hypo and an acid in presence of a colloid substance, such as albumen, fish glue, dextrine, gum arabic, etc. The sulphur does not deposit from the solution, but remains in a state (emulsion) of extremely fine division, provided that the proportions of hypo, colloid, and acid are correctly chosen.

It has been found that the best proportions for giving the desired result are as follows:—

Hypo	125 gms.	2½ ozs
Dextrine solution, 50 per cent.	250 c.c.s.	5 ozs.
Water	1,000 c.c.s.	20 ozs.

Shortly before use for toning there is added to this solution:—

Hydrochloric acid	50 c.c.s.	1 oz.

This mixture, which at first is yellowish and clear, gradually becomes milky, but the sulphur does not deposit from it even after many hours. The prints on bromide or gaslight paper on being immersed from the bath do not appear to undergo any change. But if after remaining in the mixture for from 20 to 25 minutes they are put to wash for a considerable time, the colour gradually changes into brown, and, after washing for about an hour and a-half, the final tone is reached without the slightest yellowing of the whites. The warm brown tone thus obtained exactly resembles that secured by treatment with a mixture of hypo and alum.

It is found that in the formula given above the hydrochloric acid can be replaced by alum, the separation of sulphur then taking place very slowly, and the toning process then requiring a much longer

time than with any acids. Nevertheless, a certain proportion of alum may advantageously be added to the bath for the purpose of hardening the gelatine film, and thus safeguarding it when working in hot weather. Under the name of "Virage Sep." (sepia toning) a mixture containing the necessary chemicals in the solid form is being placed upon the market under the protection of a French patent of October 7, 1911. The mixture consists of hypo, dextrine, and sodium bisulphate: it yields colloid sulphur simply by dissolving in water, and permits of brown tones being obtained in the cold exactly similar to those which are secured by hot hypo-alum toning.—"B.J.," Dec. 20, 1912, p. 972.

Direct Sulphide Toning.—J. Desalme has described a method of cold single-solution sulphide toning by means of bisulphide or trisulphide of soda prepared by adding powder sulphur to a solution of ordinary soda sulphide made in boiling water.

	Bisulphide.	Trisulphide.
Soda sulphide crystals............	50 gms.	50 gms.
Water, boiling	50 c.c.s.	50 c.c.s.
Sulphur powder..................	6 gms.	12 gms.

The crystallised soda sulphide (the substance ordinarily used for sulphide toning) is dissolved in boiling water, and the sulphur then added little by little: when it is seen to be all dissolved, the yellow solution so produced is diluted with water to 1,000 c.c.s.

A bromide print, placed in this bath, gradually tones from black to a warm sepia-brown, passing through the intermediate tones. The final tone is secured in a time which varies with different papers, but in most cases is about 30 minutes. The print must then be well washed, otherwise it will continue to tone to some extent. The high-lights are extremely pure, the gradation of the print well preserved, and the toning most even. The bath has a slight odour of sulphuretted hydrogen.

An alternative method of forming the polysulphide toning compound consists in adding hydrogen peroxide or some neutral per salt to solution of sodium sulphide. A solution of soda sulphide, containing 50 gms. of the cryst. compound in 1,000 c.c.s. of water was prepared. Of this solution 100 c.c.s. was mixed with 25 c.c.s. of commercial 12-volume hydrogen peroxide. The yellow colour of bisulphide was seen to develop gradually in the liquid, which exhibited all the properties of bisulphide. A bromide print placed in the bath tones very quickly, more quickly than in the case of bisulphide prepared according to the process already described above, the bath losing its colour as the toning process goes on. The silver of the image acts as a catalyser, splitting up the peroxide into water and oxygen, which oxidises the soda sulphide producing caustic soda and bisulphide.—"Bull. Soc. Fr. Phot.," Feb., 1913, p. 56; "B.J.," Feb. 28, 1913, p. 157.

Sepia Toning with Acid Hypo.—H. Soar has given working details of a cheap, simple, and reliable method of producing sepia tones. Like that of Lumière and Seyewetz, the tone does not develop until the prints have been washed in water for some hours, but by a modification of the method (described below) the process is shortened. The original method consists in placing the prints for about 20 or 30 minutes in a cold bath made as follows :—

Hypo	½ oz.
Water	20 ozs.
Sulphuric acid, strong	20 minims.

Add the acid just before using the solution : it renders the mixture milky and gives a weak odour of sulphurous acid.

Prints can be placed in this mixture straight from the fixing bath, or after washing and drying. They are simply turned over one another whilst in the acid hypo.

They are then set to wash for several hours so that the water acts freely on each print. This is necessary to avoid patchiness of the tone which first comes up in the washing, resulting in a warm brown.

Vigorous prints yield the best tones. For these the developer preferred is as follows :—

Diamidophenol	40 to 50 grs.
Soda sulphite	1 oz.
Water	20 ozs.
10 per cent. solution of ammonia ·880	40 minims.

Or soda hydrate, a few drops of a strong solution.

The toning bath may be heated to about 90 deg. Fahr., and will tone prints very readily, but with less risk of spoilt prints than with the hot hypo-alum bath of 170 degress. Again, by the addition of certain salts, the action is hastened and other tones than brown are obtained. Permanganate of potash added to the bromide toning bath gives a gradation of tone peculiar but pleasing. The heavy shadows are of a warm black, the half-tones of a tawny colour. With chloride of ammonium in the bath a purple tone is obtained on bromides similar to gold-toned P.O.P., and requires but the ordinary half-hour or so of washing.—"B.J.," Feb. 28, 1913, p. 156.

The modification in the method described above consists in the use of an acid hypo solution used at a temperature between 90 and 100 deg. F. The bath is made as before, namely, hypo, ½ oz. is dissolved in water 20 ozs., heated to about 96 deg. F. and 20 minims strong sulphuric acid added. Prints should have been fixed in a hardening hypo bath, made up with chrome alum and acid, as given later in this "Almanac" under "Standard Formulæ." They are then allowed to soak for a short time in water whilst making up the acid -hypo toner.

To allow the liquid to get between the prints the bath is rocked or the prints are turned about two or three times. In some eight to ten minutes they will be found to have acquired a rich warm brown tone. They are then placed in a wash-bath to remove hypo (the only washing necessary). If required to be glazed they should be given a bath of chrome alum to harden the film.

Between each batch toned a small quantity of acid is added, and occasionally hypo, to keep up the action of the bath; although, as the solution is so cheap and readily made, it is preferable to make up a fresh quantity of bath for each batch of prints.

A stronger and hotter bath tones more rapidly, but the prints are not so well under control, whilst at the temperature of blood-heat gelatine is not materially softened.

A print that has been dried before toning tones out more purple than one toned without drying.

The paper used by Mr. Soar is that supplied by Rajar, Ltd., and the developer is as given above.

For a print from a weak negative the solution is restrained with a few drops of sulphuric acid. The ammonia accelerates the action, and at the same time renders the final tone of a print more purple than one that has been toned with a developer to which acid has been added.—"B.J.," March 7, 1913, p. 185.

In a further paper MM. Lumière and Seyewetz point out that the colloidal sulphur may be obtained in the film itself, using it saturated with hypo. as it comes from the fixing-bath. The print is transferred directly, without washing, into a weak solution of about 1 per cent. hydrochloric acid, in which it remains for from 30 to 40 minutes at a temperature of about 60 deg. F. The sepia tone is obtained on subsequently washing in water for about an hour and a-half. Sufficient time must be allowed in the acid bath, otherwise the print is liable to show double tones.

The colloidal sulphur process, as described in the preceding paragraph, may be carried out on the prints as they come from the fixing-bath, and time thus saved by making the one washing serve for the removal of the hypo. and for the production of the sepia tone.—"B.J.," Aug. 29, 1913, p. 672.

H. Soar, writing in reference to the last-mentioned method, points out that it is practically the same as that of his, described in "B.J.," Feb. 28 and March 7, 1913. The essential point in the Soar process is the temperature of the water used in the process, as it rules the length of time necessary to bring out the tone. The warmth of ordinary tap-water taken direct from the main will vary according to the season. By the Soar method, in warm weather or with water heated to a temperature of 65 deg. Fahr., the desired tone is acquired with some sixty minutes' washing, following fifteen minutes' immersion in the toning bath. In the winter, therefore, the temperature of the water requires attention if quick results are to be obtained, otherwise several hours' washing will be necessary to bring out the full tone. A toning bath at blood heat will give the full tone right out in ten to twelve minutes, merely requiring the usual washing to remove the superfluous chemicals.—"B.J.," Sept. 5, 1913, p. 694.

Single-Solution Cyko Toner.—F. N. Leache has given the following method for the toning of Cyko paper, the formula being on the lines of that of Kropf ("B.J.A.," 1912, p. 618):

Water	4 ozs.
Ammonium sulphide	1 oz.
Ammonium carbonate	60 grs.
Potassium persulphate	20 grs.

Dissolve chemicals in the order given.

Heat the bath to 80° Fahrenheit, and it is ready for use, and prints should tone in five minutes

The prints should be washed, or, at least, thoroughly rinsed after fixing, and before toning in the above bath.

If much acetic acid is carried into the bath by prints not thoroughly rinsed, the solution discolours, and, naturally, the whites in the prints will be tinted in consequence.

After toning, the prints should be washed for thirty minutes in running water, or, at least, eight changes, allowing five minutes to elapse between each change.

The bath may be used as long as the action continues, but when not in use it should be stored away in tightly stoppered bottles.—"B.J." (from "Portrait," of the Ansco Company), July 4, 1913, p. 522.

OTHER TONING PROCESSES.

Uranium Toning.—A. Lux recommends, as the only efficient means of securing permanence of uranium-toned prints, the treatment of the prints, after toning, in a weak fixing bath made as follows:—

Hypo.	25 gms.
Potass. metabisulphite	8 gms.
Water	1,000 c.c.s.

in short, an ordinary acid fixing bath, but of about one-tenth the usual strength. This is used for about five minutes only, and the toned print then well washed in the usual way. The hypo bath is found to be equally serviceable in the case of prints toned with copper or iron salts for red and blue tones respectively.—"Atelier," Heft 9, 1913; "B.J.," Sept, 12, 1913, p. 697.

Arsenic Toning.—Dr. F. Kropf has discovered that a mixture containing potass. bichromate, citric acid, and arsenic acid yields a sepia tone on bromides. The mixture is, of course, intensely poisonous. The formula is:—

Arsenic acid, 10 per cent. solution	1 oz.
Potass. bichromate, 10 per cent. solution	1 oz.
Citric acid, 10 per cent. solution	1 oz.
Water	12 ozs.

In this bath bromide prints attain a sepia-brown tone in from 20 to 30 minutes, the silver image being wholly or partially converted into one of silver arsenide. The function of the bichromate is to hasten the action of the arsenic acid, which it does presumably by first forming a silver chromate more readily susceptible to the arsenic acid than the silver itself. It is possible that the process may be capable of application to other weak acids of elements which form permanent insoluble silver compounds, the metals

antimony, bismuth, and vanadium being the most promising of these. —"Phot. Rund.," Heft 6, 1913, p. 97, "B.J.," March 28, 1913, p. 242.

Warm Tones by Re-development.—Dr. R. Fischer has patented the process of preparing warm-toned prints by bleaching a bromide or gaslight print and re-developing with a substance prepared so that it forms a coloured image on re-development. For example, a black silver print is bleached in a solution of 10 per cent. ferricyanide of potassium and 10 per cent. bromide of potassium, well diluted with water, and then developed to a yellowish-brown colour in a solution of pyro, 0·1 gm.; soda, 2 gms.; and water, 100 c.c.s. Or a picture bleached as just described is developed to a red colour in a solution of thioindoxyl carboxylic acid, 0·5 gm.; acetone, 5 c.c.s.; potash, 2 gms.; and water, 100 c.c.s.—Eng. Pat. No. 5,602, 1913; "B.J.," Sept. 12, 1913, p. 712.

Green Toner for Bromides.—Harry E. Smith has published directions for making and using a green-toning formula which keeps well, particularly in two solutions, and does not contain any scheduled poison, such as oxalic acid or oxalates. The toner is rapid in action and yields prints of colour from rich olive green to bright grass green, according to the time of action.

The formula is as follows:—

STOCK SOLUTION No. 1.

Potassium ferricyanide	2 gms
Water (distilled)	100 c.c.s.

STOCK SOLUTION No. 2.

Vanadium chloride (Merck's syrupy)	2 gms.
Iron and ammonium citrate (green scales) ..	1 gm.
Sodium citrate (neutral)	25 gms.
Ammonium chloride	2 gms.
Hydrochloric acid (strong, pure)	14 c.c.s.
Water (distilled)	100 c.c.s.

The vanadium chloride is purchased as Merck's syrupy. An ounce bottle of it is drained into a metric measure, 12 c.c.s. of pure, strong hydrochloric acid added, and distilled water poured in to make 62 c.c.s in all. This mixture forms a solution, each c.c. of which contains ½ gm. of the syrup as purchased. Thus, 4 c.c.s. of the stock solution is used in making up the No. 2 solution of the toner.

The iron and ammonium citrate must be the green, not the brown variety; it is obtainable from large chemists, such as Merck. The sodium citrate is the "neutral pure" of Merck, and the hydrochloric acid the pure strong acid of 1.19 sp. gr. The commercial yellow spirits of salt must not be used.

In mixing up the No. 2 stock solution, first add the 14 c.c.s. of strong hydrochloric acid to the 2 gms. of vanadium chloride (that is, to the 4 c.c.s. of concentrated vanadium chloride stock solution), then dissolve the iron and ammonium citrate, the sodium citrate, and the ammonium chloride in the 100 c.c.s. of distilled water, and add the mixture of vanadium chloride and acid to the

This is a camera made throughout of special non-rusting metal. The body, base-board, and dark-slides are of German silver; the other part of nickelled brass. Only the frame of the focussing screen is of wood (teak), and this is reinforced by a metal plate

and it is useful to note this, for, once it has been properly made up, this colour indication is a valuable guide on a subsequent occasion. If it turns out green, there is something wrong. An error in weighing out too little sodium citrate, for example, would be shown in this way. The toner should not be green until No. 1 and No. 2 solutions are mixed for use.

For use, dilute one part (in c.c.s., minims, or ozs.) of No. 1 stock solution with four times its bulk of water. Then, in a separate measure, dilute one part of No. 2 stock solution also with four times its volume of water. Add No. 1 to No. 2, and the toner is ready for use.

Prints should be toned for from four to eight minutes, according to the shade of green required, then washed in five changes of water of two minutes' duration each, and immersed in dilute hydrochloric acid (2 per cent. strength) for two minutes. After a final wash of fifteen minutes in about seven changes of water they may be hung up to dry.

The prints should be kept moving, or the dish should be rocked, during toning and while the high-lights are being cleared in the dilute acid bath. Washing in running water, instead of in changes of water, is not recommended for green toning by this process. When the print tones quickly—say, in two or three minutes—as will often happen with gaslight prints and bromide postcards, the clearing bath of dilute hydrochloric acid is scarcely necessary, and its omission in such cases should not affect the permanence of the prints. As a matter of fact, no prints toned in this solution have faded in the least. That is a guarantee of several years, at all events, for this formula was worked out and prints toned with it some five years ago.

There is no need to have the black and white bromide print either lighter or deeper than usual. Prints of ordinary density tone perfectly. The time of toning, as in other processes, varies a little with the nature of the print. Gaslight prints usually tone more rapidly than bromides; and a soft, delicate print on either paper will tone more rapidly than a crisp print of the density generally used for sepia toning with sodium sulphide. Both the developer used and the brand of paper also seem to affect the duration of toning, though usually to a very limited extent.

While four to eight minutes is given as a suitable time for toning, it may be found that ten minutes or even longer will occasionally be necessary if a bright grass-green is desired. The longer the toning, the brighter the green.

As a further guide, if four minutes' toning gives a rich olive green, eight to ten minutes will usually yield a grass-green shade. A fine emerald green usually comes between these limits.

Of course, as with most of these vanadium toners, the final colour is not definitely seen until the print has been washed; but with the

above formula, although the acid clearing bath and final washing produce a change in the tone, this alteration is not nearly so great as with several other formulæ that have been recommended. With the above toner, a trial on one or two prints is enough to enable most people to determine easily the time required for a given tone. If, however, the first application of the bath gives too dark a green, it is a simple matter to tone the print again exactly as before, when the brighter shade of green desired should be obtained without any difficulty.

It is necessary to keep carefully to the proportions given above, both in making up the stock solutions and in measuring them out for use. This should not be forgotten, because when Solutions 1 and 2 are mixed the green vanadium salt that does the work is kept from precipitation by the sodium citrate; and an undue proportion of either hydrochloric acid or of ammonium chloride would inevitably separate this green compound.—"B.J.," May 30, 1913, p. 416.

Local Colour-Toning of Bromides.—A. D. Hitchin gives working methods for producing colour effects, consisting chiefly of brown, reddish, and bluish tones, by means of local toning. A good bromide of brilliant character is necessary; flat prints yield only muddy flesh-tints. The requisites are three or four brushes, Nos. 3 to 5, some "Maskine" (Penrose and Co.), petrol and Plasticine, The following solutions are prepared :—

Ferricyanide Bleacher.

Potassium ferricyanide	½ oz.
Potassium bromide	½ oz.
Water	20 ozs.

Sulphide Solution.

Sodium sulphide	1 oz.
Water	20 ozs.

Gold Toning Solution.

Gold chloride	1 gr.
Thiocarbamide	6 grs.
Sulphuric acid (1 in 40)	½ oz.
Water	4 ozs.

Different shades of brown for special effects may be obtained by the substitution of potassium iodide or common salt for the potassium bromide of the bleaching solution.

After deciding which parts of the print are to be altered in colour, paint out with the bleaching solution all the parts to be either sepia or flesh tint.

When the silver forming this part of the image is completely converted (this is determined by the almost entire disappearance of the image), the surface moisture is now blotted off carefully by using the edge of a piece of blotting paper. Should some of the bleaching solution find its way on to other parts of the print at this stage, the parts may be redeveloped by application, with a brush, of any of the usual developers used for bromide prints.

The print must now be placed *face downwards* in a dish of water, so allowing the bleacher to sink. This is important, for if the

print is placed face upwards, the gradual dissolving out of the solution will partially bleach the image of the surrounding portions of the print.

The water must now be changed frequently until it is free from yellowness. It is now placed in the sulphide solution until chemical action is complete.

Four or five changes of water should now be given and the print pinned up to dry.

It has now a not unpleasing appearance, but a much more finished and satisfactory result may be obtained by treating the parts of the print representing flesh with the gold toning solution.

This brings us to the third stage in the process.

The parts that we wish to remain sepia are now painted out with "Maskine," or any other varnish that will act as a resist to the gold solution, by preventing its contact with the sepia portions.

It is not necessary to apply the "Maskine" to the black parts of the print, as these remain unaltered even after prolonged immersion.

We now take a piece of Plasticine and roll it out to about the thickness of a lead pencil. This is placed in a circle around the parts we wish to tone to a flesh colour and pressed down sufficiently to form a watertight joint.

The gold solution is now poured into this confined area and allowed to act until just before the desired colour is reached. It is then poured off the print, which is then placed face downwards in water.

The reason for the use of Plasticine is to allow as little solution to be used as possible, otherwise a difficulty may be experienced in staying the action at the right moment, owing to the continuing action of the solution absorbed by the paper and gelatine. Half a dozen changes of water are now required, and the print is pinned up to dry.

When this stage is reached, the removal of the "Maskine" or varnish, whichever is used, is an easy matter. A pledget of absorbent cotton is moistened with benzine or petrol, and with gentle rubbing the resist is removed.

In the case of some varnishes, it will naturally be necessary to use the solvents used in the preparation of those varnishes. For instance, in the case of celluloid varnish, amyl acetate would be required.—"A.P.," Dec. 16, 1912, p. 601.

The Carbon Process.

Reducing Carbon Prints.—A. J. Jarman gives practical directions for making the hypochlorite reducer for carbon prints. Chloride of lime (4 ozs.) is shaken up with warm water (36 ozs.), allowed to settle, and the clear portion, when cold, poured off. Of this liquid 20 ozs. are added to 60 ozs. of cold water and the prints treated as follows :—One of the prints is taken and dipped by holding the top of the print with the fingers and thumbs of both hands, then drawn with care and dexterity into the liquid, face up, the print having been previously wetted in cold water. The tray is

rocked slightly, the print then drawn out quickly and thrown into a large, deep tray of clean cold water, after which it is passed into another tray containing a 5 per cent. solution of common alum for about two minutes, then well washed and suspended to dry.—"Cam," June, 1913, p. 309.

The Ozobrome Process.

Times of Contact Required by Different Tissues.—Thomas Manly gives the following times of immersion for Illingworth's Ozobromo tissues :—

Colour group A, requiring 15 seconds immersion.—Engraving black, warm black, blue-black, ordinary sepia, portrait brown, dark blue, sea-green, platinum black, standard brown, and similar colours containing black pigment.

Colour group B, requiring 10 seconds immersion.—Warm sepia, nut brown, red chalk, terra cotta, Italian green, etc.

Colour group C, requiring 7 to 8 seconds immersion.—Dark violet, Milan green, crimson, bright red, and similar bright transparent colours.

It is a general rule that Ozobrome tissues, which contain a larger proportion of pigment than others, such as the blacks and opaque browns, require more acid than the lightly pigmented plasters, such as warm sepia and other transparent browns, and as the quantity of acid absorbed is proportional to the time of immersion, the time of immersion determines the depth of colour.—"B.J.," Jan. 10, 1913, p. 35.

Ozobrome Acid Bath.—Thomas Manly recommends, as an improvement on previous acid baths for the Ozobrome process, the following formula :—

Water	20 ozs.	1,000 c.c.s.
Chrome alum, pure	2 ozs.	100 gms.
Oxalic acid	3 drams.	20 gms.

WORKING STRENGTH.

Three ounces made up to 20 ozs. with water, or 150 c.c.s made up to 1,000 c.c.s with water.

This bath is suitable for good bromide prints *free from fog*, but as a large proportion of bromide prints (especially enlargements) have a practically imperceptible veil of deposited silver over the high-lights, it is advisable for those who are not making bromides every day to add to 20 ozs. of the diluted bath 60 to 120 minims of a 10 per cent. solution of citric acid. By this addition the high-lights will be cleared and the differences in gradation will be more prominent without losing detail.

The pigment tissue (plaster) is brought into this acid bath after immersion in the Ozobrome pigmenting solution and, in the acid, brought into contact with the bromide print. This is found to be a better method than addition of acid to the pigmenting solution.

The average time of immersion of the soaked plaster in the working acid bath is 15 seconds, but some transparent colours require

a shorter immersion. The transparent browns, such as warm sepia, nut brown, golden sepia, etc., only require an immersion of 10 seconds, and the very transparent pure colours such as violet, lilac, carmine, bright red, light blue, etc., require only 7 seconds' immersion. In any case a shorter immersion (counting seconds) of the plaster in the acid bath will give a stronger picture than the bromide print, and a longer immersion will produce a more subdued effect. In making Ozobromes from prints on gaslight papers a somewhat shorter immersion of the plaster is advisable—say, 10 to 12 seconds.

In transferring the plaster, after immersion in the acid bath, it is strongly recommended to draw the gelatine surface once or twice along the surface of the water in which the contact with the bromide print is being made, immediately before bringing the papers together. This gets rid of any superfluous acid solution, and secures evenness in skies and light background. A natural or platino-matt surface bromide paper is better than a baryta coated, or a hard, shiny surface, as the latter, being non-absorbent, allows no escape for any superfluous acid solution carried by the plaster, and the squeegee will not always drive it out. Some carbon-surface papers are quite satisfactory, and if the above precaution is taken no difficulty whatever is encountered. Occasionally one comes across a plaster which has become hard and refractory through long keeping; it rolls up when placed in the pigmenting bath, and refuses to adhere properly to the bromide print or transfer paper, and frills in the developing. The remedy is to sponge the gelatine surface with glycerine (1 part glycerine to 1 part water) before immersion in the pigmenting bath. Allow about five to ten minutes for the glycerine to soak in. Any streaky appearance may be disregarded. The surface of the pigment plaster may be rubbed over with a wet sponge if it is desired to prevent curling in the pigmenting bath.

SYNOPSIS OF THE PROCEDURE FOR NO. 2 OR TRANSFER METHOD.

1. Immerse plaster in Ozobrome pigmenting solution (of working strength) for	2 to 3 minutes.
2. Transfer the soaked plaster to the acid bath (working strength), and bring it into contact with the bromide print under water, say....................	1 minute.
3. Squeegee the papers together, and allow time for the chemical action to take place	15 minutes.
4. Strip impressed plaster from the bromide print, and squeegee the transfer paper and allow 5 minutes between blotting papers.	6 minutes.
5. Developing in warm water.	5 minutes.
Total	30 minutes.

In method No. 1 step No. 4 is omitted, but the silver image beneath the pigment image has to be removed by a bath of hypo (which ought to be done after drying), say, ten minutes in the hypo bath and ten minutes washing. So that No. 2 is really the shorter

method, and the most satisfactory, as a separate carbon picture is obtained and the bromide print is preserved unimpaired. Of course, by immersing five or six plasters in succession in the pigmenting bath five or six Ozobromes can be completed in nearly the same time.—"B.J.," Oct. 18, 1912, p. 799.

The Oil Process.

Pencil-coloured Oil Transfers.—M. R. Demachy has devised a further development of the transfer form of oil printing ("B.J.A.," 1912, p. 625). The oil impression is transferred to a suitable paper, and there coloured with crayons. The best papers for the print are the Van Guelder hand-made papers Nos. 40, 41, and 31, the Arche white unsized paper, and the Ingres drawing paper for charcoal drawing. Smooth or very finely grained papers, like the Canson drawing papers, take the colour too evenly, and when worked upon too long show a waxed, shiny surface. One wants a certain roughness of texture—a tooth—for the colour to get hold of.

Suitable coloured crayons are those of Hardmuth, Conté, Faber and others. They are chosen for the transparency of their pigments, hence vivid colour effects like those of opaque pastel are impossible. Pastels are not suitable on account of their opacity; with them it is a question of redrawing the whole picture.—"A.P.," June 23, 1913, p. 597.

An exhibition of the very beautiful results obtained by M. Demachy by this parti-photographic method was held at the offices of the "Amateur Photographer," July, 1913, and is reviewed by F. C. Tilney in "B.J.," June 20, 1913, p. 480.

The Bromoil Process.

Bleaching Solutions.—J. Switkowski recommends a modification of the bleacher prepared according to the formula of F. J. Mortimer ("B.J.A.," 1913, p. 673). Switkowski, however, prefers to use ammonium in place of potassium bichromate, and he gives the quantity of hydrochloric acid in the solution. His formula is:—

Copper sulphate..................	12 gms.	190 grs.
Potassium bromide	10 gms.	160 grs.
Ammonium bichromate...........	5 gms.	85 grs.
Hydrochloric acid, chem. pure	7 drops.	7 drops.
Water	120 c.c.s.	4 ozs.

This is a stock solution which, for use, is mixed with four times its bulk of water. Bleaching occupies about 5 minutes, and after a brief rinse the prints are placed for about 5 minutes in a 1 per cent. solution of hydrochloric acid. Here they become completely bleached, and are then fixed for 5 minutes in an acid hypo bath in order to remove the silver bromide formed in the film from the action of the copper bromide. After a wash in five to seven changes of water they are ready for pigmenting.

In the case of prints of great contrast the bleaching bath recommended is as follows:—

Copper sulphate	4 gms.	70 grs.
Sodium chloride (common salt)....	2 gms.	35 grs.
Ammonium bichromate	7 gms.	120 grs.
Hydrochloric acid................	5 drops.	5 drops.
Water	150 c.c.s.	$5\frac{1}{4}$ ozs.

This bath tends to reduce the contrast, doubtless as the result of the greater proportion of bichromate. It is immaterial whether the bichromate salt be that of ammonium or potassium, so long as the rule be borne in mind that 4 parts of ammonium bichromate correspond with 5 parts of potass. bichromate.—"Wien. Mitt.," Dec. 10, 1912, p. 705; "B.J.," Jan. 10, 1913, p. 25.

Bromoil Bleachers.—R. Zima finds the most satisfactory bleaching formula for the bromoil process to be that of Dr. Mayer, viz., as follows:—

Potass. bichromate	1 gm.
Potass. bromide	6 gms.
Copper sulphate	6 gms.
Hydrochloric acid, 10 per cent.	1 c.c.
Water	210 c.c.s.

In the case of some bromide papers it was found that this solution possessed the drawback of requiring a relatively long time, 15 to 20 minutes, for complete bleaching. This, in Herr Zima's experience, is readily remedied by further addition of hydrochloric acid. The 10 per cent. acid should be added drop by drop as it is found to be required, and no injurious effects upon the paper were noticed so long as the added acid did not exceed 1 c.c.—"Phot. Korr.," Dec., 1912, p. 555; "B.J.," Dec. 27, 1912, p. 991.

Failures in Bromoil.—A. H. Johnston gives as his experience that the most usual causes of failure in bromoil printing are:—(1) Incorrect exposure of the print; and (2) use of an exhausted bleaching solution. His procedure is as follows:—A dry print on Ilford Bromona paper is bleached in Williams' bleaching solution at a temperature between 65 deg. and 75 deg. F. No acid bath being necessary, the bleached print, after rinsing, is placed in the hypo bath for five minutes, and, after a short washing, dried—prints which have been dried before inking behaving much better than those taken from the washing water. All liquids are kept below 75 deg. F., a higher temperature making the gelatine too soft, and causing blistering. Before pigmenting the dried bleached print is soaked in water about 70 deg. F. for five minutes, and it will then take the ink perfectly.—"A.P.," April 28, 1913, p. 417.

Relief in Bromoil.—Bertram Cox gives some practical hints on the bromoil process. He prefers as developer of the bromide print a weak amidol formula of:—Amidol, 30 grs.; soda sulphite, $\frac{1}{2}$ oz.; bromide, 5 to 10 grs.; water 30 ozs. This develops slowly, but gives a print which takes the ink well. It is a good plan to judge of the print by noticing that the image is fairly vigorous on looking through the back of the paper.

The bleacher preferred is the "Silvax," as it leaves a practically invisible image on bleaching. The bleacher should be applied to the print after first soaking in water, not to the dry print. Its action is complete in about five minutes. The solution can be used repeatedly, but a fresh solution gives more pronounced hardening of the gelatine. In the case of a used bleacher, addition of a trace of sulphuric acid will improve it in this respect. All washings should be done at 55 deg. F. as near as possible.

In preparing the print for pigmenting the secret of obtaining ample relief is to place the print in cold water and gradually to raise the temperature up to 90 to 100 deg. F.

The relief required is determined by the consistency of the pigment used, which, again, varies with the type of print used, and the result aimed at. The relief necessary for ease of working cannot be judged by the *visible* relief. Imagine a print with a full scale of tones, lights in juxtaposition to the darks: the relief visible will soon be evident, and probably insufficient. A flat print, with a gradual scale of tones and no high-lights, will give little or no visible relief, and may be easily over-swelled. A good plan is to allow a narrow white margin to remain at least on one edge of the print, thus indicating relief at once. The only sure way of dealing with a strange paper is to try it, before carrying relief too far. It is at this stage that one finds it necessary to accustom oneself to the use of one brand of paper.

The capacity of the gelatine for taking greasy matter is limited, and the best results are obtained when this limit is reached, using ink containing a maximum of colouring matter. The capacity of the gelatine varies according to the amount of swelling necessary to differentiate between the slight tones in the deepest darks. Therefore the consistency of the ink required to produce the best results depends upon the type of bromide print to be pigmented, assuming the swelling to be correct, and the best result a reproduction of the original tones of the bromide. In actual practice, this is indicated by ease in pigmenting, and by what may be termed incorporation of the pigment with the gelatine. These conditions go to make quality in a bromoil.

A heavier action of the brush is necessary for rough papers, for obvious reasons, but, even then, it should be only sufficient to secure a uniform action of the brush on the paper. Hopping should only be resorted to where any departure from the original tones is required, or when, because of prolonged working, the print has slightly dried. In conjunction with the above methods Sinclair's inks and brushes work most satisfactorily.—"A.P.," March 31, 1913, p. 310.

Dye Prints as Basis for Bromoil.—O. Mente has given working details of the Benham process as modified by Thiebaut and himself. He recommends it as a simple means of providing a permanent image of almost any colour which may be required upon which a Bromoil impression may afterwards be put. Thiebaut's results have been published in "Les Epreuves au Bichromate par Teinture Direct," published by Charles Mendel, of Paris. A good gelatine-

coated paper, such as Autotype No. 77 transfer paper, is sensitised with a mixture made as follows :—

Ammonium bichromate	18 gms.	800 grs.
Copper sulphate..................	8 gms.	360 grs.
Manganese sulphate..............	3 gms.	130 grs.
Water distilled	200 c.c.s.	20 ozs.

In the dry state the paper keeps for about eight days, but it is best to print within forty-eight hours of sensitising. Printing presents no difficulty to anyone who has had experience in judging the depth of a correctly printed platinum paper. The time of printing will be a little longer than that for collodio-chloride paper : it is better to give a little more rather than too short a time. A very good rule for correct printing is that the highest lights remain unaltered, whilst the light half-tones show the detail visible in the negative. An aid to judging the correctness of exposure is provided in a light blue sheet of glass, through which the printed image may be observed As a rule short exposure to intense light gives better results than longer exposure to a weaker light.

The washing of the prints, or, at any rate, the laying of them in water, should be done by weak light. Running water, or frequent changes, provided that the water is not unduly cold, will remove the excess of bichromate within twenty minutes as a rule. It is not sufficient to go by the colourlessness of the wash water as a criterion of complete washing : the high-lights of the print, when the latter is held up to the light, should be seen to be quite free from yellow colour.

In order to make more certain that the chromate salt is completely washed out it is a good plan to pass the prints through a bath of common salt (sodium chloride), that is to say, the prints are washed in running water until the chromate is seen to be almost gone, then dipped for a minute or two into the salt solution, and again washed in running water. The salt solution is renewed as soon as it is seen to be yellow. Too long washing must be avoided since it reduces the oxidising power of the primary image.

The print bearing this primary image may be hung up to dry and dyed up when convenient, or may be dyed as it comes from the wash-water.

Dyeing, or "development," takes place, in the case of a correctly exposed print, in a quite automatic fashion, that is to say, as soon as the formation of the colouring matter has reached its maximum in all parts of the print longer immersion in the bath will not alter this depth. This is the case if the dyeing bath is not too acid : too much acid will reduce prints which remain long in the bath. Some hints may be given as regards the dyeing :—The solution should be filtered through cotton wool before use : about 3½ ozs. of solution is ample for 6 to 10 prints of 7 × 5 size : the solution should always be thrown away after use. The colouring matter appears to be formed at the first in all parts of the print, gaining in strength in the shadows after a certain time, during which, also, the lights appear to clear, although this effect may possibly be due merely to the growth in contrast between the lights and shadows. After dyeing,

a wash of about ten minutes suffices to remove the excess of dye bath. Any fog over the print may be removed before washing by means of the solutions mentioned below. The dyeing baths, given below, if made up with boiled distilled water, will keep for a fairly long time, and may, therefore, be prepared in sufficient quantity.

The simplest dye bath, and one which yields excellent pure sepia tones on the No. 77 Autotype transfer paper, is the following:—

Pyro	1 gm.	90 grs.
Acetic acid	5 c.c.s.	1 oz.
Water	100 c..c.s.	20 ozs.

Any slight fog is removed by means of an alum solution. Prints tending more to olive tones and of great intensity are obtained by adding to the above developer :—

Pyrocatechin	1 gm.	90 grs.

On the other hand, more reddish tones are secured by addition of :—

Hydroquinone	1 gm.	90 grs.

A formula for a pyro dye bath, which yields extremely nice dark green tones, is :—

Pyro	1 gm.	90 grs.
Sulphuric acid, chemically pure ..	3 c c.s.	4 drams.
Ferrous sulphate	2 gms.	180 grs.
Water	100 c.c.s.	20 ozs.

Should a black precipitate be formed in preparing this solution, addition of acid, drop by drop, will redissolve it. It seems impossible to avoid clouding the high-lights when using this bath, but such fog is readily removed by placing the print in a weak bath of oxalic acid, or in weak sulphuric acid, or strong alum solution. Herr Mente was unsuccessful in obtaining good results with gallic acid baths, even when adopting the after-treatment recommended by Dr. Thiebaut, but a formula for paramidophenol, which proved good, may be given :—

Paramidophenol	1 gm.	90 grs.
Gallic acid	2 gms.	180 grs.
Alcohol, 90 per cent.	20 c.c.s.	4 ozs.
Alum	1 gm.	90 grs.
Water	100 c.c.s.	20 ozs.

A brick-red tone is produced in this bath and is changed into a brown on immersion in soda carbonate solution.

General fog over the whole print may arise both from over and under-exposure. Insufficient acid in the dye bath is the most general cause. A dip in strong oxalic acid solution, or in one of acid sulphite, will remove the fog, but the general strength of the print also suffers. This is particularly the case with pyro : prints made with paramidophenol are not so readily attacked. A very good means of removing fog produced by pyro consists in the well-known Eau de Javelle (sodium hypochlorite). The print is laid flat in a dish and a 10 per cent. mixture of Eau de Javelle in water flowed

over it. As soon as the gelatine surface is felt to be tacky the print is gone over with the finger or a tuft of cotton wool and the fog thus cleared off by what is a purely mechanical method. As soon as it is seen that the print is cleared, the latter is placed at once in a weak solution of acetic acid, again washed in several changes, and hung up to dry. Should the bath of Eau de Javelle have been allowed to act for too long the print may be redyed in a somewhat more weakly acidified pyro bath: this will bring up again details which have suffered, but not the fog. This treatment with Eau de Javelle followed by redyeing may be used with advantage in securing greater pluck in prints. Its effect is that of reducing foggy negatives and then intensifying.

The coating mixtures for gum printing may be applied to the print without further preparation, the image well resisting the process. Where artistic control of the dye print is thought desirable before putting a second impression on it the Eau de Javelle treatment above described may be employed locally. Where a second impression is to be made by means of oil-pigment it will, of course, be found, as a rule, that the first dye print does not need to be so strong, since the gelatine will be too strongly tanned: a few tests will show the correct degree.—"Atelier," Heft 1, 1913, p. 2; "B.J.," Jan. 17, 1913, p. 42.

Miscellaneous Printing Processes.

Uranium-Silver Printing.—According to a recent patent of E. Rickman an improved silver-uranium printing paper is obtained by addition to the sensitiser of small proportions of thiocarbamide compounds and of haloid alkaline salts, such as ordinary sodium chloride (common salt). The more of this latter the solution contains, the greater the tendency of the finished print towards a yellowish-brown; the greater the proportion of thiocarbamide, the blacker the prints. The addition of these two substances to the silver-uranium sensitiser renders the paper non-liable to alteration of tone in patches when washing the finished prints. A specimen formula of the sensitiser is as follows:—

Uranium nitrate	·25 gms.
Silver nitrate	9 gms.
Thiocarbamide solution, 1 : 20	·5 c.c.
Sodium chloride, 1 : 100	·3 c.c.
Water distilled	50 c.c.s.

This sensitising mixture is applied to papers prepared with starch. Ger. Pat. No. 255,837 of June 14, 1912.—"B.J.," Feb. 14., 1913, p. 129.

Water-Developing Kallitype Paper.—Teresa del Fabro has patented the preparation of an iron printing paper in which prints of black tone are obtained by the use of water only as the developer. In making up the sensitising solution a solution of ferric oxalate and oxalic acid is mixed with a solution of nitrate of silver, and to the mixture thus formed is added a few drops of hydrochloric acid

and ferrous chloride; after which the mixture is applied t the paper in the usual manner. After drying, the paper is ready for use.

By the union of the ferric oxalate with nitrate of silver and the treatment of the mixture with hydrochloric acid and ferrous chloride, there is obtained a new series of blacks which produce a good imitation of stamps, manuscripts, and engravings.

A solution (A) of the following substances is warmed:—

Ferric oxalate	36 gms.
Oxalic acid	5 gms.
Distilled water	100 c.c.s.

Since the ferric salt of commerce contains a certain quantity of ferrous salt, it is necessary to convert the latter into the former. This may be done by adding to the cooled solution above a sufficient quantity of a 10 per cent. solution of permanganate of potash.

A 16 per cent. solution (B) of nitrate of silver is then prepared.

For use, the two solutions (A) and (B) are mixed, in the proportion of 3 of the first and 1 of the second, adding one drop of ferrous chloride and one drop of hydrochloric acid to every 10 c.c.s. of the solution. This mixture is applied, in a weak light, to ordinary paper, which, when dry, may be used at once, although it is better to leave it some days. The paper thus prepared can be developed in water or it may be developed with soda or potassium salts, neutral or acid.

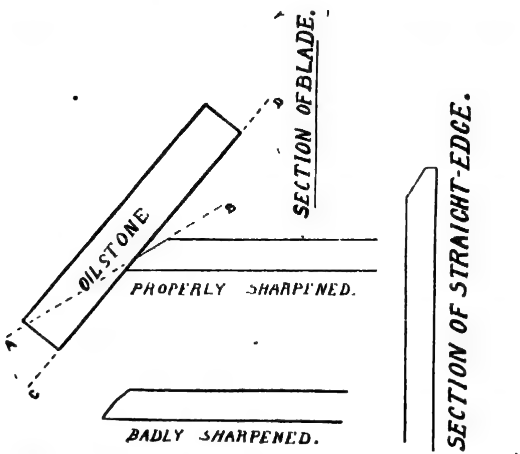
In order to eliminate the undissolved ferric salt (that is to say, without impression of the light) the print must be immersed in a weak solution of acid oxalate of potash, if a good black colour is desired; or in a weak solution of oxalic acid, if sepia is preferred; in both cases the photograph must be well washed until the yellow colour has disappeared; after this, the print must be washed again in running water, or water often renewed, and fixed with a weak solution of hyposulphite, adding a few drops of hydrochloric acid. In about 3-4 minutes this is finished and the print, after being rinsed, is put to dry. Eng. Pat. No. 11,193, 1912.—"B.J.," June 13, 1913, p. 460.

Cutting an Ivory Miniature.—In cutting an ivory miniature to fit a metal rim there is considerable danger of splitting the ivory. If the cutting is done without due consideration for the grain there is every possibility of starting a nasty crack across the picture. The wrong way to go to work is to consider the ivory as a piece of card and to make the cut all in one direction—that is to say, to begin at one side and to turn the picture round, cutting straight on. The right way is to mark the desired size on both back and front of the ivory, and to start cutting *with the grain* from the middle of the right-hand side. Then the ivory is turned with the back towards the worker and the other corner cut in the same direction. The ivory is then turned end for end, and the remaining two sides cut in the same way. A pair of strong, sharp nail-scissors should be used. The advantage of working in this way is that all four corners are cut with the ivory in the most convenient position, and

in such a way that the cracks must occur in the piece which is cut off.—"B.J.," Jan. 24, 1913, p. 59.

Trimming and Mounting Prints.

Sharpening Trimming Knives.—For obtaining the blade of a trimmer, such as the "Merritt," in the best condition, it is necessary to remember that all cutting tools are ground, as shown in the drawing, with two angles, the long edge from A to B being to thin the blade down, so that the shorter cutting angle along the line C D may be more easily and quickly sharpened. In the case of a trimming machine one should move the oilstone on the blade, while holding the latter firmly, from end to end of the blade as well as from end to

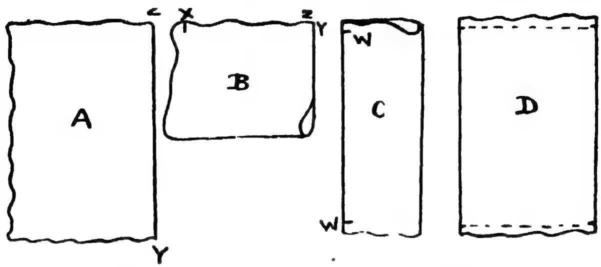


end of the stone. It is important that the stone should be flat, so one side of the stone might be kept for this purpose only; but it is still more important that the stone should not be rocked, but kept at the same angle, or a round edge will be produced which will soon get blunt, and which is more difficult to sharpen.

Occasionally the long angle should be ground with a coarser stone, preferably a carborundum hone, as this kind cuts quickly, and the work of trimming will be helped by keeping the cutting edge of the steel straight-edge square and sharp in the same way."—"B.J.," Feb. 14, 1913, p. 124.

Trimming with Knife and Straight-edge Only.—D. Berlin points out the convenience of the following method for trimming enlargements, etc., beyond the scope of the ordinary cutting mount or trimming board:—The print is laid flat and a cut made on one side, ZY, according to the subject. The line ZY is folded along itself as

at B, making the print lie as flat as possible without actually making a crack at the fold; holding the print thus with one hand, a nick is made with the knife at X through both thicknesses, and on opening out the print a cut can be made from one nick to the other, giving us

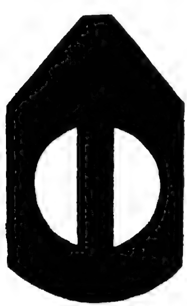


two parallel sides. It is then necessary to fold again as at C, so that these two edges lie exactly together, and to make nicks as before at WW; the paper is once more laid flat and cuts made joining these nicks, when the print will be found to be as accurately cut as if a trimmer or a set-square had been employed.—" B.J.," July 25, 1913, p. 577.

Removing Greasiness from Mounts.—W. Butcher and Sons, writing in reference to the mounting of prints on boards having a somewhat greasy, inky surface, state that the difficulty is got over by dusting the printed surface of the mount with a little fine French chalk.—" B.J.," Nov. 15, 1912, p. 890.

Enlarging.

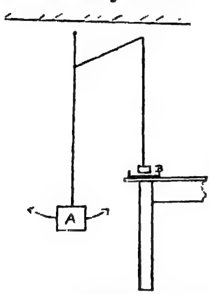
Focussing in Enlarging.—W. A. Richardson recommends the following simple means of obtaining perfectly sharp focus in making



enlargements. A stop, as shown in the figure, is cut to fit the lens. It should be made as large as the lens will allow. This will give

the maximum light to work with. To use this method, place the stop in the lens in the usual way. If the focus is correct one image only will appear on the screen. If, however, the focus is out the least bit, two images will appear. The method of use is as follows :—Rack in or out as required until only one image can be seen. You then have correct focus. Remove focussing stop and expose, when sharpness can be depended upon. This method can be used when photographing in the ordinary way : procedure, the same.—"B.J.," Aug. 22, 1913, p. 653.

Timing Exposures when Enlarging.—A method of timing enlargements, whereby an audible click is given for every second, is described by "P. G." It provides a ready means of controlling the time given to the enlargement, and is useful particularly when shading or vignetting different parts of the enlargement, as these operations can be done without the need of watching the dial of a watch or clock. The weight A (a flat iron does well) should be 6 or 7 lbs., and is suspended from a nail or other support, the length of string being altered until it swings thirty times in 30 seconds. A length of a little over 3 ft. will do this. About 6 ins. from the point of support another and thinner string is connected to the other and passed over a nail, as shown in the sketch. The small weight, B, is connected to the end of this thin string at such a distance that it rests on a piece of glass, or, better, a porcelain dish, on the table or other convenient support. This small weight can be any small piece of metal about one or two ounces.



When the pendulum is started swinging it will lift the small weight off the glass, and on its return it will make sufficient noise to enable the user to count the beats. When using, uncap when the click is heard, and call this 0, and call it 2 for every click.

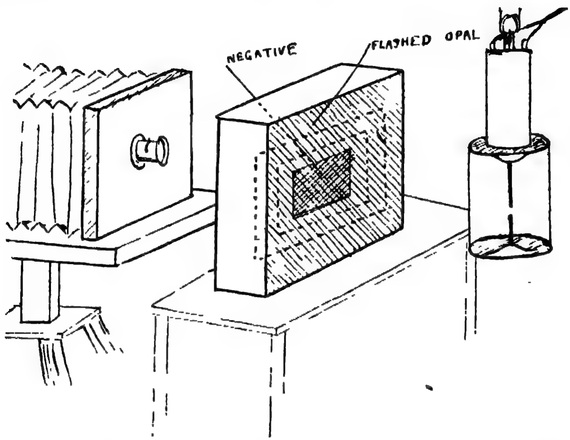
This will continue for about 180 seconds, but for longer exposures any such method is not very suitable.—"A.P.," Dec. 30, 1912, p. 664.

Avoiding the Mantle-pattern in Enlarging.—W. E. Boyle gives a useful hint in reference to preventing the pattern of the mantle from showing in the enlargement when incandescent gas is used as a light-source. Part of the glass chimney of the burner is ground to a matt surface with fine emery cloth moistened with water. Only one side of the chimney is thus ground over the space next to the mantle, so that by turning the chimney in its holder a clear or diffused light can be obtained at will.—"Phot.," Dec. 3, 1912, p. 462.

Flash Opal in Place of Condenser.—A. Handford recommends the use of single flash opal, such as is supplied by Hetley and Co., Soho Square, London, W., for the illumination of a negative for

enlargement by an arc lamp. The arrangement shown in the drawing allows of a 12 by 10 negative being perfectly evenly illuminated. If 12 by 10 is the largest size from which it is required to enlarge *or reduce*, a box should be made 18 in. square by 5 in. deep; in the "top" is fitted a set of carriers from 12 by 10 down, and in the bottom a sheet of flashed opal the full size (18 in. by 18 in.).

The negative is put in the carrier, the box stood on end, and the arc lamp lowered till level with negative. It will be perfectly illuminated, even if the arc is within a foot of the opal, and will give enlargements softer and freer from grain than are obtain-



able with a condenser, and with as short an exposure, the studio lamp being, of course, much more powerful than the lantern illuminant.—"B.J., January 24, 1913, p. 74.

Vignetting Enlargements.—In producing vignetted enlargements much time may be saved by realising the definite movements which are necessary in order to produce given effects.

The essential movements are six in number, and it will be convenient to tabulate them as follows :—

1. Movement to and fro between lantern and easel.
2. Vertical movement of vignetter.
3. Horizontal or cross movement of vignetter.
4. A rotatory movement in the plane of the vignetter.
5. A vertical swing to and from the easel.
6. A horizontal or side swing about a vertical axis.

The first of these movements is absolutely essential in order that we may get a vignetted patch of the right size and of the required degree of softness. The nearer the vignetter is to the lantern the

softer is the outline and the larger is the patch, while the movement also permits one vignetter to be used for a variety of different degrees of enlargement. The vignettes of any one shape will serve for all enlargements likely to be required.

The desirability of the second and third movements is obvious, for in the case of vignetting a portrait it is essential to get the head in exactly the right position within the vignetted patch. This adjustment can, however, be made by shifting the negative up or down or sideways, in the lantern, and if the lantern has these movements they will to some extent compensate for the lack of similar movements in the vignetter, though they are not so efficient, as they do not permit the same fineness of adjustment.

The fourth movement may also be obtained in the lantern by rotating the negative instead of the vignetter, but as many lanterns have no provision for such an adjustment it is generally necessary to arrange for it in the vignetter, and in practice it is found better to move the latter rather than the negative. The importance of this rotating movement is appreciated when vignetting a head that is in three-quarter face or profile. The best vignetter for such a subject will generally be one with an opening of an irregular pear shape, or something like a large comma with a big head and a very short tail, and with any vignetter of this irregular form a very slight rotatory movement will often turn a very unsatisfactory effect into one that is all that can be desired. Moreover, it will enable the same vignetter to be used for several different negatives.

The fifth movement—the vertical swing—enables us to regulate the height of the vignetted patch to a nicety, and also gives us a little control over the shape of the patch. Suppose the vignette to be a perfect oval—it never will be in fact if we take any trouble to vignette properly, but we must assume a perfect figure for the sake of illustration—then by inclining the vignetter vertically we can reduce the height of the oval, and so make one oval serve for a number of different subjects.

With the sixth movement—the side swing—we can produce the same effect horizontally. Suppose, again, we are using the comma-shaped vignetter, then with the aid of the vertical swing we can bring the tail part nearer the lantern than the upper part, and so cause the tail part to transmit more of the subject than it otherwise would.

With regard to the vignetter itself, it is necessary to have this in the centre of a fairly large screen, a foot square at least, and larger if possible. The vignetter itself, however, need be no bigger than a lantern-slide. If cut circular and fitted in a circular aperture in the large screen, the fourth rotatory movement is obtained readily. If we take two sheets of mounting board of the same size, cut a four-inch hole in the centre of one and a three-and-a-half-inch hole in the other, the two, when glued or pasted together, will form the screen, with a rebated central hole, into which hole four-inch vignettes can be dropped, and held in with card turn-buttons fixed with paper-fasteners. The vignette itself can be made from this card or stiff paper. The screen can be held by a clamp on an

ordinary retort stand, which alone will provide all the necessary movements at very small expense.

Another method is to fix overhead rails, from which the screen is suspended, or to fit the screen with feet and stand it on a table. These methods have, however, the disadvantage of leaving out two important movements, or, at any rate, of making them more difficult to arrange—these are the vertical movement and the vertical swing, and while the former may be replaced by a raising or lowering movement of the negative-carrier, the latter cannot be reproduced in the lantern at all.

The vignettes should, of course, be serrated, and the serrations should be numerous and fairly deep, so that they can be turned back in places where it is needful to let through a little more light. With a view to this, it is preferable to make them in thick tinfoil or thin sheet lead or aluminium, for one vignette with a little adjustment can then be made to serve for a great number of different subjects.

In making the vignettes it should be remembered that we are very apt to over-estimate the size required. It is best to begin with a hole that seems obviously too small, and then enlarge it as is found necessary.—"B.J.," January 10, 1913, p. 18.

Lantern Slides.

Hydra Physical Developer.—Dr. C. W. Philpot recommends the Paget "Hydra" developer as a much superior method of physical development than that with metol and silver nitrate. With Barnet slow gaslight plates it gives a fine brown tone. The developer, as purchased, is dissolved in boiling water in the proportion of 7½ grains per ounce. The exposure required is about 3 ins. of magnesium ribbon at a distance of 15 ins., and development must be carried on until the image is very clearly seen, quite fully out, at the back, and appears by transmitted light much over-developed.—"Phot.," March 25, 1913.

Physical Development of Lantern-Slides.—R. E. Crowther, F.C.S., recommends the following feebly acid preparations as "physical" developers for lantern-plates :—

I.	Amidol	5 grs.
	Sodium bisulphite	7 grs.
	Water (boiled or distilled) to	1 oz.
II.	Diamidophenol	4½ grs.
	Sodium bisulphite	5 grs.
	Water (boiled or distilled) to	1 oz.

The Hydra developer (preparation of hydrazine) supplied by the Paget Prize Plate Company is also found to be an excellent physical developer of lantern-plates, and particularly suitable for obtaining wide range of contrast beyond the powers of the ordinary developer. In the use of such physical developers the two chief rules are to avoid under-exposure and under-development. The image is liable to lose a good deal in the fixing bath (which should be of the acid

type), but development may be done for a very much longer time than customary without fear of blocking up the shadows.—"A.P.," December 2, 1912, p. 548.

Lantern-slides by the Powder Process.—Harold Holcroft, M.A., F.C.S., has given working details for the making of lantern transparencies by the powder process, such slides requiring to be printed from a positive, but otherwise permitting of extremely rapid work and yielding results of highly transparent stain-like quality.

The first part of the process is to clean the glass perfectly, for which purpose a mixture of ammonia, methylated spirit, and French chalk is used. The cleaned glass plate is then coated with the sensitive mixture of gum arabic, sugar, and bichromate. This is flowed on and drained off, and the plate then whirled to give an even coating. It is then dried at a moderate temperature, not above 80 degrees F., the operation being best done in a drying oven, which can be readily extemporised from a biscuit tin heated by a tiny gas ring. The dried sensitive plate is printed in daylight by aid of an actinometer, the exposures ranging from 1 to 10 or 15 minutes in the shade. After exposure, the film is again placed in the drying oven for five minutes at the same temperature as before, and then, whilst still warm, laid face up on a sheet of glazed paper and a little of the powder which is to form the image dusted over with a very soft and dried brush. The powder commences to adhere in about a minute, and the "development" is finished in from three to four minutes. As soon as sufficient depth has been obtained the slide is ready for masking and binding.

Supplementing the above general instructions, the following additional details are given :—

The brushing must be done by artificial light or very subdued daylight. With films produced with the whirler there is no actual need for any washing. The very attenuated film, with its trace of bichromate salt, is only just perceptible. Such slides, not washed, show no observable change of any kind after some months' exposure to daylight, and are probably as permanent as any photograph can be. If washing is preferred, after a few minutes' exposure to daylight, the films can be put safely into a dish of water and given two or three changes of water.

This absence of any necessity for washing only applies to films of the thinnest possible nature produced with the whirler, and made from fresh colloid solution; and does not apply to films made with old, highly coloured colloid, nor to thick films. In this case, the films should be put into the window, glass side towards the daylight for a day, when they will become insoluble enough to stand ordinary washing in cold water.

It seems difficult at first to believe that a film of such soluble materials as gum arabic and sugar, with a trifle of bichromate salt, could do otherwise than dissolve at once in the first wash water; but it is true enough. The action of light in conjunction with the bichromate salt produces such a resisting film that when you have

to clean off old spoilt films from the glass you will have a lasting respect for the resisting powers of the film.

Colloid Solution.

A colloid mixture which is found to work well for lantern slides is :—

Best picked white gum arabic	32 grs.
Loaf sugar	32 grs.
Potassium bichromate	10 grs.
Water	1 oz.

The solution works best when quite fresh, and should not be used when over two days old.

The time required for preparation is much shortened by grinding all three solids into powders fine enough to pass through a 50-mesh sieve; a small stock of an ounce or two of each should be kept in separate bottles; or the requisite quantity of each powder for 1 oz. of solution can be weighed out in spare time into little paper packets or cartons, as many as required. The cartons are kept in wide-mouthed bottles. The powders keep indefinitely.

When the colloid solution is wanted the powders are weighed out or taken from the cartons, and added to the proper quantity of cold water, stirring vigorously all the time with a glass rod to prevent the gum collecting into masses. By this method the colloid solution can be prepared in a few minutes. The solution must now be filtered into a small stoppered bottle, by means of a small glass funnel in which is inserted very loosely a small plug of absorbent cotton wool.

One fluid ounce of colloid solution is ample for lantern slide work. This quantity could probably be made to cover 100 plates at a nominal cost for material.

The colloid solution rapidly undergoes changes even in the dark. The changes which take place are a deepening of the colour, an increase in viscosity, and some alteration which results in an increase of sensitiveness to light in the dried film. Stale solution gives films which do not take the powder satisfactorily. It is good practice to work always with fresh solution under constant conditions, as far as possible.

As regards the function of the components of the sensitive solution, the gum, of course, supplies the body of the film, but by itself the gum would not absorb the necessary moisture from the air to give the powder image. The sugar is added to confer this property upon the film. If too little sugar is used, the powder image does not develop up easily; if too much is used there is a difficulty in keeping the high lights clear. The purity of the high lights or the amount of deposit required upon them should be regulated by the proportion of sugar.

In any case, if the proportion of sugar is increased or diminished, the proportion of gum should be diminished or increased at the same time, so that the amount of sugar, *plus* gum, is constant. The object of this is to retain approximately the same viscosity in the solution, as the viscosity is one element in determining the

thickness of the film, which is an important matter. The speed of the whirler is another factor in determining thickness of film, but it is convenient to keep this as constant as possible, and with Sanger-Shepherd's whirler the highest speed should always be used to secure perfect films.

If it is desired to obtain thinner or thicker films this is best attained by increasing or diminishing the proportion of water in the solution, which governs the viscosity. By reducing the speed of the whirler a thicker film can be obtained, but it is not easy to judge the speed exactly, and a slower speed may result in thick edges, which are not desirable.

As a thick film will take more powder than a thin film, variation of the viscosity in the colloid solution is the best way of regulating the depth of the shadows in the image.

The proportion of the bichromate salt should be as high as possible to increase the sensitiveness to light, but should not be great enough to cause the salt to crystallise out when the film dries, as this spoils the film altogether. On occasions, in dealing with a hard positive, the bichromate salt may be reduced somewhat.

The proportion of sugar in the formula given is adjusted to give an image which will take the powder freely, and, at the same time, to keep the high lights clear for three to four minutes in the ordinary atmosphere of this country. It will not require alteration except for countries where the air is abnormally dry or moist, or for exceptional slides.

Exposure.

Exposure should always be made with an actinometer.

If the exposure is correct the image will develop up gradually. The deep shadows will begin to show in one minute, the half tones will follow, and in about three minutes the details in the high lights will begin to take the powder.

An under-exposure is known at once by the powder adhering all over the plate too quickly.

Over-exposure is recognised by the high-lights failing to take the powder at all within three or four minutes.

In other words, assuming that the colloid solution is properly adjusted, and the atmosphere of the room normal, a properly exposed lantern slide from an average positive will develop up gradually and completely in from three to four minutes.

In first experiments, no attempt should be made to vary the constitution of the colloid solution given, but assuming ten minutes is the correct exposure, four plates should be exposed at, say, four, seven, ten, and twenty minutes, and the behaviour in brushing carefully observed. Under and over exposure will soon be recognised.

Powdering the Image.

The exposed film should always be placed in the drying oven again at 80 deg. F. for five minutes, and the brushing commenced at once with the warm film.

The reasons are, first, that the film may have become unduly moist during exposure; and, secondly, by starting the powdering

on the warm film, the image comes up evenly and gradually under standard conditions, and the time for complete development is some indication of correct exposure. There is also the fact that if the image comes up in a reasonable time you are better able to give careful and uniform distribution of the powder.

If the powder is applied at once to the cold plate from the printing frame, the image may flash up so quickly that the image may be spoilt in powdering.

The brushing must be done very gently, and with a very soft brush, otherwise brush marks may be visible. It is well to dry both the brush and the powder before beginning work.

POWDER COLOURS.

For lantern slides and transparencies a large number of different powders may be used successfully, and it is only necessary to name a few which have been found to work well with the colloid solution recommended.

The essential points in a powder for this purpose are :—

(1) It must be ground uniformly to the required degree of fineness.
(2) It must be bone dry, and not hygroscopic.
(3) It must not clot or aggregate into lumps during brushing.
(4) It must not be affected by the bichromate salt.
(5) The powder should be of a permanent character.
(6) It should be to some degree transparent, so that the deepest shadows may transmit some light.

There are some colours which differ in hue in layers of different thickness. These give a double tone effect, and should be avoided.

The various colours of ferric oxide from red to purple, powdered glass, powdered flints, and many of the mineral colours sold by drysalters, all work well, and comply with all the requirements. Gas black, if carefully dried, is good; so are many of the enamel colours used for burning on pottery, although they may not be actually burnt in on the slide. Rouge, as used for polishing, works perfectly.

On the other hand, precipitated barium sulphate, oxide of zinc, oxide of tin, dry white lead, or precipitated chalk are not satisfactory, or, at all events, require considerable modification in the colloid solution. Some of them also react with the bichromate salt.

Electrotypers' graphite and bronze powders, in my experience, are not suitable or fine enough for lantern slides, and it is not easy to grind or elutriate these substances.

The small quantities of the powders recommended here are readily produced if required by pounding in a mortar until fine enough to pass through a 50-mesh sieve. A small glass muller and a plate glass slab will then soon reduce this powder to any requisite degree of fineness.

Small sieves can be made quickly with cardboard and seccotine and bolting silk, or some other textile.

The powders must be kept free from dirt, and dried bone dry. They are best kept in corked bottles or tubes.

A pure black which is entirely satisfactory is not found to be

obtainable. Any opaque powder—for example, vermilion—will give a black upon the lantern sheet, but what is required is a black which is slightly transparent, and the light which is transmitted must be a pure grey.

The colours given by all the powders upon the lantern sheet differ very much from the colours as seen by reflected light. Rouge gives a rich orange brown. Flints give brown. Best gas black gives a neutral sepia, powdered glass gives a grey which may be warm or cold in hue according to the colour of the glass. Ordinary red brick gives a warm black.

It will be evident that it is necessary to test the colours by actual trial upon the lantern sheet.

Maxims for Successful Working.

(1) Clean glass plates.
(2) New colloid solution
(3) Careful filtering.
(4) Regulate depth of shadows by thickness of film.
(5) Regulate thickness of film by the viscosity of the colloid solution.
(6) Regulate the amount of deposit on the high light by the proportion of sugar.
(7) Drying oven not to exceed 80 deg. F.
(8) Use Sanger-Shepherd's whirler.
(9) Expose by actinometer.

If these maxims are carried out with reasonable care in manipulations there is no difficulty in getting eleven or twelve first-rate slides out of each dozen exposures.—"A.P.," Oct. 21, p. 402, and Oct. 28, p. 433, 1912.

Masking Lantern-Slides.—Writing in reference to the method of masking lantern-slides, described in the "How To Do It" section of the 1913 "Almanac," J. Watson writes:—

The plan I have adopted for the last ten years or so is similar, but there is less waste. I cut my masking paper (not always needle paper) into strips $3\frac{1}{8}$ ins. wide and any convenient length. I lay the slide on a piece of ruled paper, which rests on a glass slope. A brush carrying a small quantity of gum or dextrine is dragged across the film surface of the slide, below the line where the edge of the mask is to come. The *end* of the $3\frac{1}{8}$-in. strip (with a clean edge) is then brought up to the right place, and the paper is pressed down on the slide. The slide is then lifted from the slope and turned over so that the paper is undermost. The surplus strip is cut off with scissors, close to the edge of the slide. If carefully done, the edge is ready for applying to the slide for another side of the mask. There is no waste until the end of the strip is reached, and the trouble of finding a side of a convenient width is saved.—"B.J.," Dec. 6, 1912, p. 946.

Metal-Surface Lantern Screen.—S. Shaw has patented a metallic lantern screen, prepared as follows:—

Material having a painted or enamelled surface is used, e.g.,

"carriage roofing," that is, cotton cloth or canvas, coated with white paint, or enamel, similar to the material very generally used for covering the tops of eating-house tables. On the painted or prepared side of this sheet, which has of itself a glossy finish, is applied a suitable clear size, or varnish, or even isinglass, in a liquid or almost liquid state, preferably by coating with a soft brush, care being taken to prevent unevenness or streakiness.

After the size, varnish, or isinglass has been applied, and before it has had time to set fully, we spray dry, finely powdered aluminimum, or other bright metal or material in a powdered state, having a silvery appearance and capable of adhering to the size and of producing a bright silver-like surface on the material. The superfluous material is dusted or lightly brushed off, the silver-like surface so produced when set forming an extremely effective ground for the pictures projected.—Eng. Pat. No. 17,276, 1912. "B.J.," May 30, 1913, p. 425.

Cinematograph.

(Space will not permit of reference to the numerous patents for cinematograph cameras, projectors, and films for animated photography in monochrome and natural colours. The specifications are published or abstracted in "The British Journal of Photography," and entered in the annual index of that publication under (1) Cinematographs and (2) Name of patentee.)

VI.—COLOUR PHOTOGRAPHY.

Patents for Colour Photography.—The chronology of the patent specifications relating to colour photography commenced in the monthly "Colour Photography," Supplement to the "British Journal of Photography," Jan. 4, 1907, is concluded with the issue of Dec. 6, 1907, p. 96. All current patents are dealt with week by week in the "British Journal of Photography," and are entered in the annual index under (1) Colour photography and (2) Name of patentee.

The Three-Colour Process.

Colour Prints from Bromides.—E. G. H. Lucas has taken out a further patent in reference to that of 1908 (No. 27,959) ("B.J.," Jan. 28, 1910). The later patent describes further methods of obtaining ink impressions in colour from specially treated bromide prints by rotary printing, etc. Eng. Pat. No. 18,965, 1911. "B.J.," Oct. 25, 1912, p. 829.

Colour Prints by Colour Development.—R. Fischer has patented a method of producing colour prints, suitable for forming the elements in a three-colour reproduction, by direct development. A

developer is used which, instead of giving a black image, yields one of yellow, purple-red, or blue. The process may be employed in various ways, but the following is an example of its application to a screen-plate negative in colours :—

With a complementary-coloured screen-negative an exposure is made through a blue-filter on a transferable panchromatic layer of emulsion. The exposed picture is developed with pyro, fixed, and the silver removed, say, by Farmer's reducer. The developer is made up as follows: Pyro 1 gm., soda carbonate 5 gms., water 100 c.c.s. Such a developer will give, as is well known in the case of a pyro developer used without a "preservative," such as sodium sulphite, a yellow picture, which is removed and transferred to a suitable backing or support.

An exposure is then made through a green filter on a similar layer, and a purple-red picture developed in the following developer: 0·5 gms. of thioindoxyl carboxylic acid, 5 c.c.s. of acetone, 5 gms. of potash, and 100 c.c.s. of water. After fixing and removing the silver this red picture is transferred on to the yellow one.

Finally, by using a red filter, an exposure is made on a panchromatic layer, and this is developed in the following developer: 0·5 gms. of indoxyl carboxylic acid, 5 c.c.s. of acetone, 2 gms. of potash, 100 c.c.s of water. After the removal of the silver and silver halide this blue picture is transfered on to the two former pictures.—Eng. Pat., No. 15,055, 1912. "B.J.," Aug. 1, 1913, p. 595.

Three-Colour Prints.—G. Baugé has patented a process of preparing three-colour prints in which the novel features claimed are the use of certain mixtures and proportions of dyes; the use of scales of colours and shades for the purpose of checking exposure and development of the negative and of ascertaining, before combining the component prints, whether the colour rendering is correct; also the use of a non-stretching paper as support for the colour impressions is claimed. The colours employed for the three prints are as follows :—

For the red colour a madder lake of the desired shade is used. This lake is incorporated into a gelatinous mixture and spread to the extent of about 8·5 gms. per square metre of paper.

For yellow, cadmium sulphide is used, obtained by precipitating a solution of soluble salt of cadmium, and, after washing and drying, the cadmium sulphide is incorporated into the gelatinous mixture and spread on the paper, about 12·8 gms. per square metre being used.

The blue is obtained by using the precipitate prepared by precipitating a solution of ferric salt, such as a solution of sesquibromide of iron, of 11.85 per cent. strength, by means of a solution of ferrocyanide of potassium of 21 per cent. strength. This precipitate is incorporated with the gelatinous mixture and spread to a density of 6 gms. per square metre after having been brought to the desired value by comparing it by means of a colorimeter with a standard solution.

These mixtures, except the yellow, when spread on glass are transparent.

They are spread on a special paper under the name of "vegetable parchment," which has been parchmentised by dipping it into a mixture of sulphuric acid and nitric acid. This paper is then dipped twice into a saturated solution of gum-lac in ethanol before applying the coloured gelatine. In this way non-expanding paper is obtained which, if necessary, can be printed on the back.—Eng. Pat. No. 20,251, 1911. "B.J.," December 20, 1912, p. 979.

Raydex Colour Prints.—Samuel Manners has described the process of obtaining three-colour prints from sets of colour-sensation negatives by an adaptation of the Ozobrome process to which, in its form for three-colour work, the name of Raydex is given. Good fully developed prints or enlargements having been made from the negative on bromide paper, such prints are brought in contact with Raydex colour sheets, sensitised at the time by immersing for at least two minutes in a solution composed of 60 minims No. 1 Raydex solution and 20 minims of Raydex No. 2 solution made up to 1 oz. with water. For the yellow sheets, 5 minims of No. 2 solution are taken instead of 20.

As a matter of routine the yellows are sensitised first, and applied to the bromide prints; then, using the same solution, 20 minims more of No. 2 are added to each ounce for the reds and blues. They are allowed to remain in contact for some minutes, till action is complete.

After being separated, the colour sheets (now bearing the images) are developed by means of hot water, on glasses coated with a thin substratum of insoluble gelatine. The most convenient temperature is about 105° F. The action being a definite one, the effect of using hotter water, or longer immersion, does not appear to make any appreciable difference in the results.

A little practice, easily acquired, is necessary to bring the colour sheets quickly in contact with the bromide prints, otherwise there is risk of losing the delicate half-tones.

The colour sheets should be brought in contact with the bromide prints under the surface of water, then withdrawn, and squeegeed. The bromide prints can be re-developed and used again. Superimposition is simple, and can be done in a few seconds. A special temporary support is soaked in water till limp and squeegeed on to the blue print. When dry it is stripped by means of a weak solution of hydrofluoric acid, washed for a few minutes, and applied to the red print, quickly moved about, till superimposition is obtained, and, when dry, again stripped.

The temporary support now bearing the blue and red colour prints is, after a slight wash, superimposed on to the yellow. They are then stripped, washed for a few minutes, and placed on a permanent support under the surface of water, withdrawn, and squeegeed. After drying, the temporary support is removed by hot water, and the finished print is ready for trimming and mounting.—"B.J." Colour Supplement, April 4, 1913, p. 16.

An improvement has since been made in the above method by the use of a special Raydex transparent support. These are waxed at least half an hour before use. The colour prints are then developed,

allowed to dry, and a piece of temporary paper support which has been soaked in water squeegeed in contact with the yellow print.

When dry, which usually takes place in a warm room in about half an hour, it is easily stripped from the support. The temporary paper support bearing the yellow print is then rubbed over with a little benzole to clear off any traces of waxing solution. It is then wetted and applied to the blue print, and, when dry, stripped, treated again with benzole, and applied to the red print. If reversal of the subject as regards right and left is immaterial, the temporary support, now bearing the three prints, when dry and stripped, may become the final support, and is ready for mounting. If it is desired to have the subject right way about, the yellow print is superimposed last, and when stripped from the transparent support is cleaned with benzole, and applied to a final paper support.

Colour Prints by Mercury Toning.—A. Hamburger has patented a method for the production of colour-photographs depending on the chemical toning of a bromide print. A yellow tone is obtained by toning the bromide image with a mercuric-iodide solution. The print is first bleached with ferricyanide-bromide, or other bleacher, and then toned, or darkened, to a yellow colour in mercuric-iodide. This print then serves as the yellow impression in making a three-colour print.

The paper of the print should preferably be parchmentised in order to obviate shrinkage. Bleaching and toning formulæ are as follows :—

Potassium ferricyanide, 5 per cent. solution	1 part.
Potassium bromide, 5 per cent. solution......	1 part.

or

Lead nitrate, 5 per cent. solution	30 parts.
Potassium ferricyanide, 10 per cent. solution	10 parts.
Aluminium nitrate, 10 per cent. solution......	10 parts.
Nitric acid	1 part.
Acetic acid	15 parts.
Water	50 parts.

The bleaching is carried out until a faint grey image only remains, when, after washing as usual, the print is immersed in the following toning solution :—

Mercuric chloride, 6 per cent. solution	40 parts.
Potassium iodide, 8 per cent. solution	60 parts.

When the desired tone is attained the prints are removed and washed in the usual way. It is to be observed that the tone continues to develop after completion of the immersion in the toning bath, and allowance must be made for this in determining the time of withdrawal. The formation of yellow can be arrested by immersing the print in an acid bath at any time during the toning. In this way a print is obtained in a fine yellow colour which corresponds with the yellow portion of the picture being produced and which possesses a key or foundation of practically panchro-

matic grey. This has been obtained in one operation, without any special skill, and avoids the need of registration or fixing necessary where a separately produced panchromatic key or foundation is employed as has been proposed. The print so obtained can now in any suitable way be combined with the remaining colour prints, which may be of any suitable kind.—Eng. Pat. No. 20,880, 1911. "B.J.," October 25, 1912, p. 828.

One-plate Three-colour Processes.

PROCESSES OF PREPARING SCREEN-PLATES.

Under this heading are described processes, the products of which at time of writing (Sept., 1913), are not on the market.—Ed., "B.J.A."

Screen-plate Colour Prints.—E. C. G. Caille has patented the use of a fourth screen structure, or network, in obtaining colour prints by the screen-plate method on opaque supports, such as paper. —Eng. Pat. No. 15,935, 1912; "B.J.," Aug. 15, 1913, p. 635.

Colour Screen-Plates by Emulsion Method.—A further patent in reference to the manufacture of mosaic screen-plates by this method has been taken out by the Aktien Gesellschaft für Anilin Fabrikation. It is No. 9,167, 1912, and supplements Patents Nos. 16,273, 1910, and 6,279, 1911. Coloured solutions of colloids are scattered or sprayed by a current of gas, and the fine drops thus produced are suspended while still in the liquid state in a liquid in which they are insoluble; for instance, suitably coloured aqueous solutions of gelatine or dextrine are sprayed by means of a current of air through a nozzle, the air being preferably saturated with water vapour. The falling drops are suspended in oil of turpentine, obtaining thus an emulsion, e.g., of red drops, which, after mixing it with a corresponding emulsion, e.g., of green and of blue drops, is brought upon a sticky layer spread over a glass plate or film. The colour screen thus obtained is covered with an impermeable varnish, whereupon the screen may be covered with a photographic emulsion. —"B.J.," May 9, 1913, p. 367.

A further patent has been taken out in reference to the emulsion method of preparing a mosaic screen-plate ("B.J.A.," 1910, p. 598, where "Herman," second paragraph, should read "Christensen"). The improvement consists in the use of one or more acids for treatment of the emulsified particles, the acids being soluble in the particles.—Eng. Pat. No. 7,480, 1912; "B.J.," Mar. 28, 1913, p. 255.

Convertible Colour Screen-Plates.—M. Obergassner has patented a screen-plate for colour photography in which the colour elements of the taking screen may be converted into their complementary colours by treatment with an acid or other means, and the process of producing a transparency simplified by thus dispensing with the operations of reversal.

These colours are, for example :

For red : 1 part litmus in 4 parts gelatine, red in acid solution, or blue in alkali solution.

For violet : 1 part metanile-yellow in 4 parts gelatine, violet in acid solution or yellow in alkali solution.

For green : a mixture of :

1 part acid green,
1 part light green No. 1 and 2 solution
(so prepared by Messrs. Fuerst Bros. for colour photography),
¼ part brilliant yellow,
3 parts phenolphthalein,
4 parts gelatine,

which is green in acid solution, and becomes red in an alkali.

The bath for transforming the aforesaid colours consists of about 5 per cent. sulphuric acid or 5 per cent. soda lye, or the like, as the case may be.

According to the nature of the colours the action should be continued for about 1 to 2 minutes until the colours have completely changed.—Eng. Pat. No. 1,549, 1912; "B.J.," Feb. 21, 1913, p. 145.

Colour Screen-Plates.—O. S. and H. E. Dawson have patented a pattern of colour screen-plate in which each colour element is obtained of different geometrical shape. The advantage claimed is that in making negatives and positives for the production of duplicates in colour the action of any given colour (red, green, or blue-violet) can be readily seen by examination of the plate with a lens. One method of preparing such screen-plates is as follows :—A cross-line screen as used in the process trade is put near to and in front of a sensitive plate in a suitable camera, the object photographed being a sheet of white paper. In the stop way of the lens is a stop capable, by working in conjunction with the cross-line screen, of so affecting the light-rays that they form on the sensitive plate densities of the shape (*a*) of the figure. Such stop-opening is approximately the shape of the density (*a*). The shape and size, however, of the stop-opening varies according to the ruling of the cross-line screen, the focal length of the lens used in the camera, and the size of the density patch required.

A second sensitive plate is then put in the camera exactly in the same plane as the previous one, and, using a different stop in the lens, a second negative is made, capable, as before explained, of forming on the sensitive plate, densities of the shape (*c*) of the figure. Such stop opening is approximately the shape of the density (*c*). From these negatives, positives are made, and these become the working screens.

A piece of clean glass, film, or the like is now sensitised by one of the bichromate processes and exposed behind the first positive, thus giving, after development, densities shaped as (*a*). It is then dyed up with one of the selected colours (preferably, red), and the colour patches protected by any recognised method of mordanting or varnishing, or both. The plate is again bichromated and superimposed with the second positive, so that the clear circles of the positive fall in the spaces between the red patches. Printing and development follow, and the circular patches so formed are dyed with another colour (preferably, green) and the colour patches protected by mordanting or varnishing.

The plate is again bichromated, printed through the back, and dyed with the third selected colour, blue-violet, mordanted or varnished. Instead of producing the second colour by using the second positive it can be done by using the second negative, in which case the colour patch will be the shape (*b*) of the figure. Or the two negatives may be so made that the deposits are of the shapes respectively of a solid oval and a solid circle as, for instance, (*b*) (with no opening) and (*c*); in which case we should use the negative (*b*) and a positive of (*c*). Eng. Pat. No. 5,859, 1912; "B.J.," Feb. 7, 1913, p. 105.

Recessed Screen-Plates.—L. Dufay has patented the making of screen-film of a kind in which the minute colour elements are formed in the mass of the support. A large number of small, closely arranged recesses is formed in both sides of a thin, transparent support, the recesses preferably having vertical edges. The recesses on one side of the support are then filled up to the level of the intermediate parts of the surface of the support with a transparent, im permeable material coloured throughout in one colour, and the intermediate spaces of the support are then dyed by imbibition with another colour. The other side of the support is similarly treated, so as to produce by superposition with the colours on the first side, an optically complete selecting screen suitable for use in colour photography. The colours most suitable for producing this effect are on one side two primary colours, and on the other side the third primary colour and its complementary.—Eng. Pat. No. 15,027, 1912; "B.J.," Aug. 8, 1913, p. 615.

Screen-Plate Colour Prints.—For preparing prints from a negative made through a "taking" screen-plate G. S. Whitfield has patented a weakly-coloured screen registrable with the original taking screen. It is applied to a temporary transparent support, such as glass, and coated with a sensitive photographic medium, which need not be panchromatic, and then placed in registrable contact with a transparent colour record, the sensitive surface being adjacent to such colour record, which may be a negative or positive. Exposure is effected by transmitting ordinary light through the record, and causing such ordinary light to affect the light-sensitive coating. The light-affected surface is then treated by making a positive from a negative if the original colour record be

a negative, or by a process that will yield a positive if the original be a positive. The weakly-coloured screen with the picture thereon is, when dried, stripped from the transparent support and appropriately mounted on the opaque medium forming the final support. Preferably the screen and image are so mounted on the opaque medium that the former would be uppermost, but this is not essential.—Eng. Pat. No. 5, 144, 1914; "B.J.," Apr. 11, 1913, p. 290.

Registering Screen-Plate Transparencies.—G. S. Whitfield, of the Paget Prize Plate Co., Limited, has patented the impression upon the taking-screen of some design or lettering of a colour which transmits rays of two only of the colour elements, and is opaque to those coming through the third. For example, blue lettering passes light from the blue-violet and green elements, but absorbs that coming through the orange-red. The taking-screen, thus prepared, is placed in the dark-slide with the panchromatic plate in contact with it, and a short supplementary exposure is given to the latter through the lettering only. The lettering is thus obtained as clear glass in the negative. In printing from this negative upon a viewing screen coated with transparent emulsion the correct register is obtained by noting the production in the lettering of the brilliant complementary colour—namely, red in the example mentioned above. —Eng. Pat. No. 18,900, 1912; "B.J.," Sept. 5, 1913, p. 690.

SCREEN-PLATES ON THE MARKET.

The Lumière Autochrome.

Exposure of Autochromes.—Arthur E. Morton points out the advantage of selecting different weather conditions according to the subject—e.g., bright diffused light for near subjects, weak sunlight for mid-distance subjects, and brilliant sunlight for distant views. Dry weather is essential for most outdoor subjects, because shiny surfaces, such as the foliage of holly, laurel, ivy, and many others reflect when wet too much white light, whereby their colours may be invisible, or only partly seen, in certain places. Again, the moisture in the air gives rise to an excess of blue-violet, which causes green foliage to be recorded a bluish-green. Near subjects have the densest colours and deepest shadows, hence they require the longest exposure; mid-distant subjects have subdued colours and bright shadows, hence require less exposure; distant subjects have weak colours and usually no shadows, therefore they require the briefest exposure.

Other factors which determine the amount of exposure are the lens and stop and the colour of the object. As a basis, assume that the principal factors determining exposure are fixed, that the lens is one of $f/8$ speed, the emulsion speed (after deduction for compensator and colour filters) is Watkins 6, a good summer light—say four seconds to darken the full tint of Watkins Steadfast paper—then, for given distances one should employ for an Autochrome or

Dioptichrome screen-plate the following factors as denominators, with the actinometer light-value as an enumerator :—

Distance.	Factor.
1 to 4 ft.	1
4 to 10 ft.	2
10 to 30 ft.	3
30 to 100 ft.	4
100 to 300 ft.	5
300 upwards	6
Seascape	8
Sky	12

For the Paget colour process multiply the denominator factor by four to allow for the increased rapidity of the panchromatic plate. Preferably use the preceding factor in dull light, and the succeeding in brilliant sunlight.

Slight over-exposure is preferable for screen-plate transparencies intended for lantern projection.

Example.—The Watkins paper in a diffused light takes 10 seconds to darken to full tint, subject, an ordinary flower bed. distant 10-30 ft., stop *f*/16. Calculate as follows :—

$$\text{Autochrome}\ \left\{\frac{\text{(Light-value)}\ \ 10 \times 4\ \text{(stop value)}}{\text{(Subject factor)}\ \ 3}\right. = \frac{40}{3} = \begin{matrix}\text{13 seconds.}\\ \text{(approx.)}\end{matrix}$$

$$\text{Paget}\ \left\{\frac{\text{(Light-value)}\ \ 10 \times 4\ \text{(stop value)}}{\text{(Subject factor)}\ \ 3 \times 4\ \text{(plate speed)}}\right. = \frac{40}{12} = 3\tfrac{1}{3}\ \text{seconds.}$$

—"B.J.," Colour Supplement, May 2, 1913, p. 17.

Developing Autochromes of Great Contrast.—G. Balagny recommends the use of the acid diamidophenol developer for Autochrome subjects of extreme contrast, such as portraits in sunshine, sunlit interiors, etc. A fresh solution of anhydrous soda sulphite is prepared of 10 per cent. strength. The developer is made up as follows :—

Water	150 c.c.s.	5¼ ozs.
Soda bisulphite lye	3 ,,	50 minims.
After well mixing, add—		
Diamidophenol	1 gm.	15 grs.
Sulphite solution 10%	8 to 10 c.c.s.	2¼ to 3 drs.

If one has patience the development may be commenced with only 6 c.c.s. (100 minims) of the sulphite solution. The whole developer is well stirred so as to ensure the absence of undissolved particles. The bath should be perfectly clear and colourless. If desired, and if the exposure has not been on the under side, 10 drops of 10 per cent. potass bromide solution may be added.

The plates should be first handled in the dark, being laid in the developer contained in a genuine porcelain dish, not one of the cheap substitutes. As soon as the plate is in the developer the latter is rocked for from 15 to 20 secs., and the dish covered

against exposure to the dark-room light, which latter is then switched on and the developing dish placed near it. With the developer made as above it is unusual, even at the end of 5 or 10 minutes, to see the image fully upon the plate. But from this point the colour-sensitiveness of the plate is completely removed. We can use a bright-red light, after having rocked the dish for some little time in order to mix the developer thoroughly. This done, the plate can be examined either by reflected or transmitted light. It is here that the experience of the worker tells. A plate which shows the image plainly like an ordinary monochrome negative will turn out correctly, and may be left to proceed by itself, bearing in mind, however, that, with the Autochrome, the further development is carried the greater is the quantity of silver removed by the reversing bath. Thus fine parts of the colours may be removed, and will be replaced, after reversal, by perfectly transparent portions from which colour is entirely missing. Practice alone will show the exact point at which to arrest development.

If the plate, when examined by the dark-room light, is weak and flat, but full of detail, it is advisable to add solution of sulphite. Add at first 5 c.c.s. (85 minims) and wait for 5 minutes. If the visible details increase in strength this quantity will no doubt be sufficient. If, on the other hand, no change is seen, add a second dose of 5 c.c.s., or even 10 c.c.s. (3 drams), 10 per cent. soda sulphite solution. Wait again for, say, a further 10 minutes, and then add, if necessary, a final 10 c.c.s., making 30 c.c.s. (1 oz.) in all, or 3 gms. (45 grs.) of soda sulphite. This developer, as it is thus finally obtained, is identical with that already given, except as regards the bromide.

In reference to the suggestion of M. Monpillard to start development with no bromide, and then to develop for a fairly long time, it has been necessary to develop for as long as an hour and a-half in the case of a plate, the exposure of which had not been quite enough, but if the exposure is correct, or fairly correct, this method of treating subjects of great contrast will give results which are quite satisfactory. We work somewhat as with metoquinone. Begin by noting at the end of a few minutes the state of the plate as regards exposure, and then make suitable additions. Remember that the plate, from the first moment of development, is being treated with the maximum quantity of developer (1 gm. of diamidophenol).

The two-dish methods of development have the great defect of subjecting the image more to a soft-working bath (tending to grey negatives) than to a hard bath, which has an opposite tendency. In the case of great contrast the final result is a plate of very great density, which in the case of an ordinary monochrome subject is difficult to print, whilst in the case of a colour screen-plate it is best thrown away. The better plan is to begin with a bath containing at the start the full quantity of reducer, but this, a reducer which will exert its action little by little in proportion to the additions of soda sulphite which are made. The sulphite acts with diamidophenol like alkali with an ordinary developer.

Another method may also be employed with good results. Begin by making up the bath in the following way :—

Water	150 c.c.s.	5¼ ozs.
Stock bisulphited sulphite solution	10,15,or 20 c.c.s (according to the exposure).	3,4,or 6 drms.
Potass bromide solution, 10%	10 drops	10 drops
Soda bisulphite lye	3 c.c.s.	50 minims.
Diamidophenol	1 gm.	15 grs.

The bisulphited sulphite solution in the above formula is prepared as follows :—50 c.c.s. (1¾ ozs.) of soda bisulphite lye are mixed with 150 c.c.s. (5¼ ozs.) of water and 20 gms. (300 grs.) of soda sulphite (anhydrous) dissolved in the mixture, which thus contains 10 per cent. of the sulphite. The formula given above therefore contains from 1 to 2 gms. of sulphite, and in using it we proceed exactly as in the case where we employed the freshly made soda sulphite solution of 10 per cent. strength. We first aim at securing the maximum of detail on the plate, and then make successive additions of bisulphited sulphite, 5 c.c.s. (80 minims) at a time, as already described in regard to sulphite, in order to obtain the necessary density. If, in using this method, the desired result is not obtained, the plate is transferred to a bath (prepared beforehand) which acts much more quickly. This is the bath already given above for ordinary use, and consisting of 150 c.c.s. water, 3 gms. anhydrous sulphite, 3 c.c.s. bisulphite solution, 1 gm. diamidophenol, and no bromide. The quantity of bath given above will suffice for eight Autochrome plates treated in succession. It works on the day after making, but very slowly. It will never give rise to frilling of the plate, and leaves the film in a much harder state than developer containing alkali. Lastly, the Autochrome plates developed with acid diamidophenol present a perfectly correct range of colour values.—"Bull. Soc. Fr. Phot.," Feb., 1912, p. 371. "B.J.," Colour Supplement, Feb. 7, 1913, p. 6.

Black Spots in Autochromes.—G. S. G. uses a solution of iodine, 1 gm.; potass. iodide, 3 gms.; in distilled water, 50 c.c.s. as a stock solution to be kept at hand for the removal of black spots, from finished Autochromes. A few drops of the solution are mixed with water, and the mixture, which acts slowly, applied with a fine brush, working from the centre of the spot. If the solution acts too rapidly, it is removed with a fragment of blotting paper. After this retouching, the plate is washed for one minute, placed in the acid fixing bath for a few seconds, washed again for two minutes, and then dried.—"B.J." Colour Supplement, Dec. 6., 1912, p. 55.

Development, etc., of Autochromes.—J. McIntosh, in a paper before the Royal Photographic Society, has given his experience in an extended use of the Autochrome plates. He prefers a developer containing ammonia, and still uses the original pyro-ammonia formula of Lumière, developing, as a rule, for five times the period taken by the high-lights to appear. Longer development results in

a loss of detail, and in a white instead of a blue sky, whilst with still longer development the sky becomes pink. His working method is to secure as thin a positive as is consistent with full detail, and to build this up to the requisite degree of brilliancy by intensifying it. For exposure before re-development about one minute about three ins. from a good incandescent gas mantle is found sufficient, but it is preferable to use a few inches of magnesium ribbon on account of the lesser heat. For the second development amidol is used, and Mr. McIntosh prefers then to follow with the pyro-silver intensifier according to the original directions of MM. Lumière. For varnish he prefers a good thick celluloid varnish, made with amyl acetate and without alcohol. A thick coating is an efficient protection, but it is necessary to whirl the plate after varnishing in order to overcome the tendency to crape lines. In binding the slides, care should be taken not to apply the binding strips too moist; they should be allowed to become just tacky. This will prevent rose-coloured stains appearing as the result of damp.—"Phot. Journ.," Nov., 1912, p. 319.

H. Essenhigh Corke, in a paper, also before the R.P.S., dealt with his own methods of treating Autochromes. His regular practice was to over-expose and to control the plate in development by the use of bromide.

As regards intensifiers, he frequently used mercury, followed by ammonia for local intensification, applying a brush charged with mercury bichloride solution to the parts to be treated, and, after washing, immersing the whole plate in ammonia.

He preferred early evening in summer as the best time for Autochrome exposures, giving, as the ideal condition for an exposure, diffused sunshine (through a light cloud) for the first three seconds and direct sunlight for the remaining two seconds.

In development he first bathed the plate in total darkness for a few seconds in a weak solution of potassium metabisulphite, pouring this off and then flooding over the developer. From this point onwards he was able to work in a bright yellow light as a result of the de-sensitising effect which, in his experience, was obtained by the bath of metabisulphite.—"Phot. Journ.," Dec., 1912, p. 338.

Extra-Sensitised Autochromes.—M. F. Monpillard points out that, apart from the shortened exposure, there is an advantage in the use of Autochrome plates extra-sensitised with the solution of M. Simmen when dealing with subjects containing purple. This is readily explained from the fact that there is used in the composition of the extra-sensitising bath the dye pinacyanol, which has the property of rendering the emulsion actively sensitive to the red up to 670 in the spectrum, whilst the colour-sensitiveness conferred upon the ordinary Autochrome by pinachrome ceases in its sensitising effect at about 640 in the orange. For this same reason whilst extra-sensitising of the Autochrome plate by means of the Thovert sensitising formula containing pinachrome has the advantage of increasing the general sensitiveness of the plate to a notable extent,

it does not contribute appreciably to the improvement of the rendering of reds and violets. A recent test has clearly shown the correctness of this explanation of the beneficial effects as regards colour-rendering of the Simmen bath. In short, extra-sensitising of the Autochrome plate by the Simmen or Vallot formula, far from introducing a disturbance of the colour-rendering, empowers the plate to deal to a still higher degree of accuracy with certain colours.—"Phot. Couleurs," April, 1912, p. 77. "B.J." Colour Supplement, May 2, 1913, p. 18.

Correction of Autochromes with Tinting Glasses.—Baron A. von Hübl, in a paper on the correction of a prevailing tint in Autochromes by means of a supplementary cover glass, points out that so long as the tint to be corrected is slight, a tinting glass is a satisfactory means of remedying a defective colour rendering.—"Wien. Mitt.," Aug. 25, 1913, p. 481; "B.J." Colour Supplement, Sept. 5, 1913, p. 33.

Drying Cupboard for Extra-Sensitising.—Dr. H. G. Drake-Brockman has described a drying cupboard suitable for drying extra-sensitised plates rapidly in the dark. Convenient dimensions

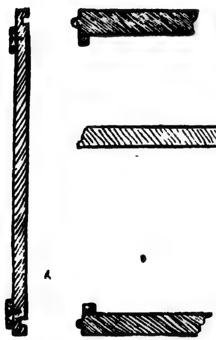


Fig. 1.

Sectional sketch, showing rebate at junction-surface of door and front of cupboard.

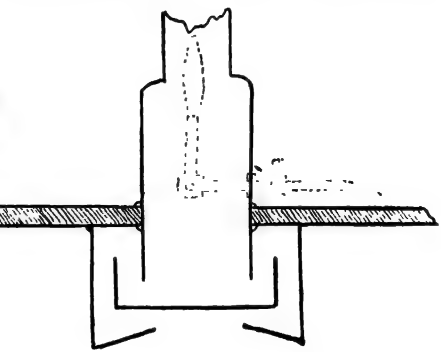


Fig. 2.

Vertical section, showing fitting of lamp chamber and light-trap in roof of box.

for use with all sizes of Autochromes will be found to be 12 x 13 x 13 ins. inside measurement of the box. This should be dead-blacked inside. It is well to have the door of the same thickness of material as the wal's and roof and floor of the cupboard, and a groove should be cut all round on the inner surface and near the edge to engage with a tongue raised on the edge of the walls. Further,

a small ½-in. beading may be fixed along the inner edge of the opening, which, when the door is shut, comes flush with the door. Thus, when closed, all light should be, and is, excluded. These details appear in Fig. 1. In order to ensure the door closing equally and efficiently all round, the hinges are made as in Fig. 6, with the turning point 3 to 4 ins. away from the box. Thus, when closing, the door fits more flat to the opening than it otherwise would.

Fig. 3.
Plate-rack.

When closed it is retained in position and locked by means of a hinged bar fitted with a wing-nut and screw, which engage with a piece of metal, with a deep notch cut in it, fixed to the door (Fig. B). The door may be efficiently and firmly clamped with no risk of inadvertent opening. This is easily done in total darkness, it being impossible to remove the nut from the bar. When closed by this

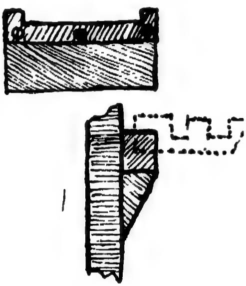


Fig. 4.
Front and side view of bracket for carrying plate-rack.

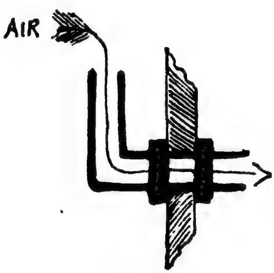


Fig. 5.
Vertical section through wall of box at point of entry of air inlet pipe.

means the cupboard is to all practical intents and purposes air-tight.

The drying of plates in such a cupboard will occupy a very long period, even days, and to obviate this and insure rapid drying a circular hole is cut in the box by means of a brace and bit on the left side below the lower hinge, and into this is fitted a ⅜-in. brass pipe which is bent twice at right angles, or, preferably, consisting of straight pieces coupled up with elbows (Fig. A). At the point where the pipe enters the box, and both outside and within, are nuts which are screwed on to the lowermost limb, which has been

previously threaded before fitting to the box. These, when screwed home, fix this portion of the pipe and insure a light-tight joint (Fig. 5). To the patent end of this pipe (marked "Air inlet" in Fig. A) is attached a calcium chloride U-shaped drying-tube.

Diametrically opposite to the opening of this pipe within the cupboard, e.g., in the roof and at the right-hand posterior angle, is cut a circular hole approximately 3½ ins. in diameter. Into this is inserted a cylindrical metal chamber of convenient dimensions. Precautions are taken, as with the inlet pipe, to effect a light- and air-tight joint. The chamber projects for 1½ to 2 ins. into the box. The upper end of the chamber terminates in a metal chimney approximately 8 ins. in height. Two holes are drilled in the cylinder; the one about 1 in. above the roof of the box, and through

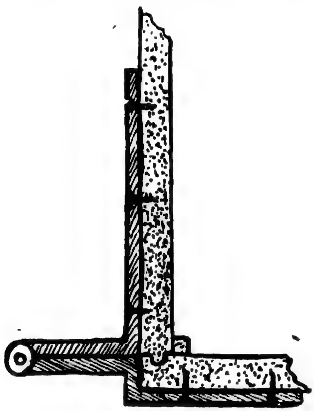


Fig. 6.
Horizontal section through hinge of door.

this is inserted a Bunsen burner. The second hole is made at such a point, and of about ½ in. in diameter, as to be on a level with the top of the Bunsen. The point of entrance of the Bunsen is made air-tight, and the second hole is provided with a small door of metal which is close fitting. The lower end of the cylindrical chamber enters a light-trap of the conventional type (Fig. 2). The aspect of the box is as appears in Figs. A and B. Thus, when the door of the cupboard is clamped and the metal door in the cylindrical chamber, e.g., lamp chamber, closed after lighting the Bunsen, all air for feeding the gas flame must be derived from the interior of the box. So efficient is the apparatus that if the air inlet be closed as well as the cupboard and the Bunsen burner lighted, after a period of two minutes the gas goes out from lack of air supply. When all doors are closed the lighted Bunsen has a vigorous pull on the air within the cupboard, and the warmer the

chimney becomes the greater is the pull, a candle flame being sucked down the inlet pipe.

Within the cupboard, and about 6 ins. from the entrance, are fitted two brackets, one on each side of the box, opposite each other, of the kind shown in Fig. 4. These carry a rack of wood, dead-blacked and soaked in paraffin wax, $2\frac{1}{2}$ ins. in width, as drawn in Fig. 3. After sensitising and surface-drying the plates by whirling and subsequently wiping the glass sides, these are placed in the rack, emulsion side up. This is easy of accomplishment in the dark. The grooves are cut of such a depth and width as to retain the plates in a sloping position quite firmly with as little contact with the emulsion as possible. The door of the cupboard

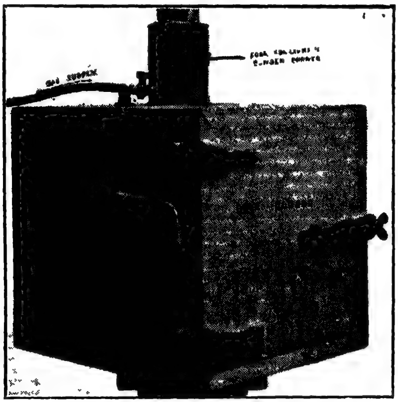


Fig. A.

The cupboard with door closed.

is closed and firmly clamped, and the whole removed from the dark room to a convenient place. The Bunsen burner is connected with a gas source by flexible rubber or metal tubing, the gas turned on and the burner lit. After about one minute the taps of the calcium tube, which is lightly filled with calcium chloride, are opened. The air within is exhausted by the gas flame and replenished through the inlet, the incoming air being desiccated *en route*. The backing cards used with the plates are placed, before sensitising, within the box, and are dried simultaneously with the plates.

In this cupboard, without calcium tube fitted, negative plates dry in approximately $2\frac{1}{2}$ hours when placed within straight from the washing tank. Autochrome plates have been found quite dry in twenty minutes, and probably have been so before this time. It has, however, been found convenient to allow this period so that no mistake or accident should arise. After drying, the gas is

turned off and pipe disconnected and the box returned to the dark-room. The calcium tube taps are closed, and the cupboard being opened the plates are again rubbed clean on the glass side, stored for future use, or loaded into plate-holders. It may be mentioned that the interior of the cupboard remains quite cool during all the time of drying.

The cupboard may also be used for drying lantern plates, ordinary negatives, and carbon tissue sensitised with a spirit sensitiser.

The outside cost of material and labour of construction works out well within twenty shillings. The cupboard should not be put

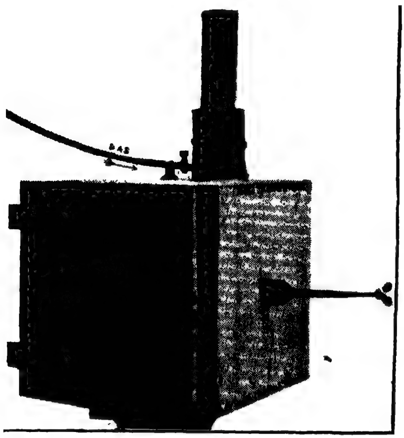


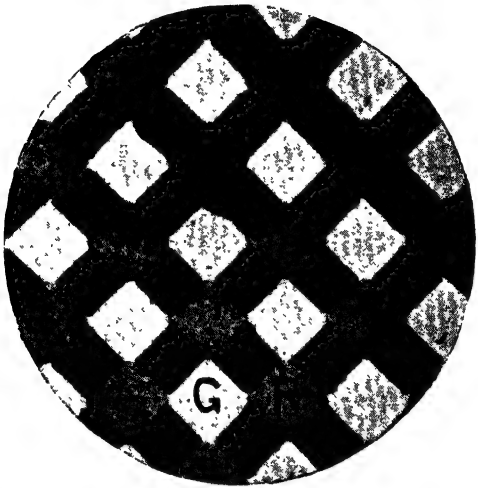
Fig. B.
The cupboard with door open.

into use till all smell of turpentine from the black paint used for the interior has vanished. This can be readily achieved by leaving the cupboard in a warmed and well-ventilated room for a few days. —"B.J." Colour Supplement, March 7, 1913, p. 9.

THE PAGET SCREEN-PLATE.

Paget Screen-Plate.—J. H. Pledge gives the following technical particulars of the Paget screen-plate:—The plate is of regular structure, and is the first to be placed on the British market, in which all three elements are of the same shape—square, in this instance. The visual order of brightness of the elements is, as usual, G.R.B. The sizes of the elements in the screens examined averaged 0·063 m/m. (1-400 inch) for the side of the blue square, and about 0.084 m/m. (1-300 inch) for the green and the red. The ratios of the

areas occupied on the screen are, roughly, blue 8, green 7, red 7, there being two blue elements in the unit. This is the first instance of a screen-plate having two separate elements of one colour in its unit. Using Dr. Scheffer's method, described in " B.J. " Colour Supplement, 1909, pp. 11-12, the "screen-period " is 20 m/m. and the "image-period" (resolving power) 0·40 m/m.; that is to say, that consequent on its structure the Paget screen-plate would be



able to distinguish between two image points having a separation on the plate of not less than ·40 m/m. (1-65 inch).—" B.J. " Colour Supplement, Aug. 1, p. 32.

The Bleach-Out Process.

Sensitisers for the Bleach-out Process.—Dr. A. Just has experimented with various compounds derived from thiosinamine for obtaining extra rapidity of bleaching of dyes. Of these new sensitisers di-ethyl-allyl-thiocarbamide appears the best. Its excellent property of crystallising permits of its being readily obtained in great purity. It is very soluble in alcohol and benzole, a point of advantage, inasmuch as benzole thus serves excellently as a fixing agent for the finished colour prints, the sensitiser being dissolved out and the colours being left behind. Since the sensitiser is not soluble in water it is more suited for collodion films than for those of gelatine.—" Phot. Korr.," April, 1913, p. 168; " B.J." Colour Supplement, July 4, 1913, p. 26.

Bleach-Out Paper.—MM. Lumière have patented a method relating to the manufacture of bleach-out paper. The paper is

impregnated before exposure with solutions of hypochlorites, hypobromites, or hypoiodites, with addition of chlorides, bromides, or iodides of the alkaline or alkaline-earth metals. Thus, a paper may be prepared with a mixture of red, yellow, and blue colouring matters, such as erythrosine, anthracene, and methylene blue, and be subsequently immersed in a solution of eau de Javelle. Among the hypochlorite compounds suitable for the process are those of sodium, potassium, barium, strontium, magnesium, aluminium, or zinc. The concentration is so chosen that in using sodium hypochlorite about 25 to 30 per cent. strength (in chlorine) is obtained in the solution. The paper after this treatment is exposed whilst still moist under the coloured original or Autochrome. The bleaching-out action takes place quickly. The print is fixed by destroying the sensitiser. For this purpose it is immersed in a reducing solution, such as sodium sulphite, soda bisulphite, or ammonia, as an alternative to which latter the paper may be fumed with ammonia vapour.—Ger. Pat. 258,241 of Dec. 6, 1911; "Chem. Zeit.," May 17, 1913, p. 276

Additions to Bleach-Out Paper.—Dr. J. H. Smith has patented the addition of certain alkaline salts of polybasic acids to the coating of dyes used for bleach-out paper in order to obtain more even bleaching-out of the colouring matters. Suitable salts are the alkaline phosphates and citrates, which may be mixed with the dye emulsion, or applied by bathing the coated paper.—Ger. Pat. No. 262,163, of Oct. 13, 1911.

KEY TO THE ABBREVIATIONS OF JOURNALS QUOTED IN "EPITOME OF PROGRESS," WITH ADDRESSES.

"A. P." .. .. "The Amateur Photographer and Photographic News."
Hazell, Watson & Viney, Ltd., 52, Long Acre, London, W.C.

"Amer. Phot." .. "American Photography."
221, Columbus Avenue, Boston, Mass., U.S.A.

"Apollo" .. .. "Apollo."
Albrechtstrasse 39b, Dresden A 10, Germany.

"Atelier" .. .. "Das Atelier."
W. Knapp, Halle a/Saale, Germany.

"Aust. Phot. Journ.".. "Harringtons' Photographic Journal."
Harringtons', Ltd., 380, George Street, Sydney, Australia.

"Aust. Phot. Rev." .. "Australasian Photo-Review."
Kodak (Australasia), Ltd., 379, George Street, Sydney, Australia.

"B. J." .. .. .. "The British Journal of Photography."
Henry Greenwood & Co., 24, Wellington Street, Strand, London, W.C.

"B.J.A."	"The British Journal Photographic Almanac." Henry Greenwood & Co., 24, Wellington Street, Strand, London, W.C.
"Bild"	"Das Bild." Neue Photographische Gesellschaft, 27, Siemensstrasse, Berlin-Steglitz.
"Bull. Belge"	"Bulletin de l'Association Belge de Photographie." Ch. Puttemans, Palais du Midi, Brussels.
"Bull. Soc. Fr. Phot."	"Bulletin de la Société Française de Photographie." Gauthier-Villars, Quai des Grands-Augustins 55, Paris, France.
"Bull. Phot."	"Bulletin of Photography." 210-212, North 13th Street, Philadelphia, U.S.A
"Cam."	"The Camera." 210-212, North 13th Street, Philadelphia, U.S.A.
"Cam. Craft"	"Camera Craft." 413/415, Call Building, San Francisco, Cal., U.S.A.; and 3, Wine Office Court, Fleet Street, London, England.
"Cam. Work"	"Camera Work." Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.
"Chem. News" ..	"The Chemical News." E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
"Chem. Zeit."	"Chemiker Zeitung." Dr. G. Krause, Cöthen (Anhalt), Germany.
"D. Phot. Zeit." ..	"Deutsche Photographen-Zeitung." K. Schwier, Sophien Strasse 4, Weimar, Germany.
"Der Amateur" ..	"Der Amateur." Mondscheingasse 6, Vienna VII, Austria.
"Der Phot."	"Der Photograph." L. Fernbach, Bunzlau.
"Eder's Jahrbuch" ..	"Jahrbuch für Photographie und Reproduktionstechnik." W. Knapp, Halle a/S., Germany.
"Il Prog. Foto." ..	"Il Progresso Fotografico." R. Namias, 36, Via Settembrini, Milan, Italy.
"Journ. Phot. Soc. Ind."	"Journal of the Photographic Society of India." 40, Chowringhee, Calcutta, India.
"Journ. Roy. Micr. Soc."	"Journal of the Royal Microscopical Society." Williams & Norgate, 14, Henrietta Street, London, W.C.
"Journ. S. C. I." ..	"Journal of the Society of Chemical Industry." Vacher & Sons, Ltd., Westminster House, Great Smith Street, London, S.W.

"Journ. Soc. Arts"	..	"Journal of the Royal Society of Arts." G. Bell & Sons, Ltd., York House, Portugal Street, London, W.C.
"Knowledge" ..	..	"Knowledge." Knowledge Publishing Co., Ltd., 42, Bloomsbury Square, London, W.C.
"Le Phot." ..	..	"Le Photo Journal." 22, Rue Vurenna, Paris.
"Mon. Phot." ..	..	"Le Moniteur de la Photographie." 17, Rue des Moines, Paris, France.
"Nature" ..	..	"Nature." Macmillan & Co., Ltd., St. Martin's Street, London, W.C.
"Oest. Phot. Zeit."	..	"Oesterreichische Photographen Zeitung." Oesterreicher Photographen-Verein, Vienna III/I.
"Opt."	..	"The Optician." Gutenberg Press, Ltd., 123, 124 & 125, Fleet Street, London, E.C.
"P. M." ..	..	"The Photo-Miniature." 103, Park Avenue, New York, U.S.A.
"Pharm. Journ."	..	"The Pharmaceutical Journal." 72, Great Russell Street, London, W.C.
"Phil. Mag." ..	..	"The Philosophical Magazine." Taylor & Francis, 7½, Red Lion Court, Fleet Street, London, E.C.
"Phil. Trans."	..	"Philosophical Transactions of the Royal Society." Harrison & Sons, 45, St. Martin's Lane, London, W.C.
"Phot." ..	..	"Photography and Focus." Iliffe & Sons, Ltd., 20, Tudor Street, London, E.C.
"Phot. Chron."	.	"Photographische Chronik." W. Knapp, Halle a/Saale, Germany.
"Phot. Couleurs"	..	"La Photographie des Couleurs." 118, Rue d'Assas, Paris.
"Phot. Indus."	..	"Photographische Industrie." 31, Blücherstr, Berlin S 61, Germany.
"Phot. Journ."	..	"Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal"). Harrison & Sons, 45, Pall Mall, London, S.W.
"Phot. Korr." ..	..	"Photographische Korrespondenz." Bäckerstrasse 6, Vienna I, Austria.
"Phot. Kunst"	..	"Photographische Kunst." Paul Heysestrasse 29/31, Munich, Germany.
"Phot. Mitt." ..	..	"Photographische Mitteilungen." Amalgamated January, 1912, with "Photographische Rundschau" under the title "Photographische Rundschau und Mitteilungen."

"Phot. Rund." .. "Photographische Rundschau."
Since January 1, 1912, including also "Photographische Mitteilungen," 19, Mühlweg, Halle a/S. Germany.

"Phot. Scraps" .. "Photographic Scraps."
Ilford Ltd., Ilford, London, E.

"Phot. Times" .. "The Photographic Times."
135, West Fourteenth Street, New York, U.S.A.

"Phot. Welt" .. "Photographische Welt."
(M. Eger), 4, Gabelsbergerstrasse, Leipsic, Germany.

"Phot. Woch." .. "Photographisches Wochenblatt."
13A, Genthiner Strasse, Berlin W.

"Photo-Era" .. .. "Photo-Era."
383, Boylston Street, Boston, Mass., U.S.A.

"Photo Gazette" .. "Le Photo Gazette."
1, Rue de Médocis, Paris, France.

"Photo-Revue" .. "Photo-Revue."
118, Rue d'Assas, Paris VI, France.

"Photo-Woche" .. "Photo-Woche."
6, Lietzensee Ufer, Charlottenburg, Berlin.

"Photographie" .. "La Photographie."
118, Rue d'Assas, Paris, France.

"Phys. Rev." .. .. "The Physical Review."
41, North Queen Street, Lancaster, Pa., U.S.A

"Procédé" .. .. "Le Procédé."
150, Boulevard de Montparnasse, Paris XIV.

"Rev. Trimest." .. "Revue des Travaux de Recherches."
A. Lumière et ses Fils, Lyons.

"Sci. Amer." .. .. "The Scientific American."
Munn & Co., Inc., 361, Broadway, New York, U.S.A.

"Sonne" .. .. "Sonne."
Kaiser-Platz, 18, Wilmersdorf, Berlin.

"Wiener F. Phot. Zeit." "Wiener Freie Photographen Zeitung."
Gustav Walter, Alserstrasse 71, Vienna VIII. Austria.

"Wien. Mitt.".. .. "Wiener Mitteilungen."
Graben 31, Vienna I, Austria.

"Wilson's" .. .. "Wilson's Photographic Magázine."
122, East 25th Street, New York, U.S.A.

"Zeit. für Instr." .. "Zeitschrift für Instrumentenkunde."
Julius Springer, Berlin.

"Zeit. für Repro." .. "Zeitschrift für Reprodúktionstechnik."
W. Knapp, Halle a/Saale, Germany.

"Zeit. für Wiss. Phot." "Zeitschrift für Wissenschaftliche Photographie."
J. A. Barth, 16, Dörrienstrasse, Leipsic, Germany.

RECENT NOVELTIES IN APPARATUS.

BY THE EDITOR.

[These notices are confined to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.

The items in this section are indexed in the General Index to Text placed at the end of the volume.]

THE ADAMS STUDIO REFLEX CAMERA.

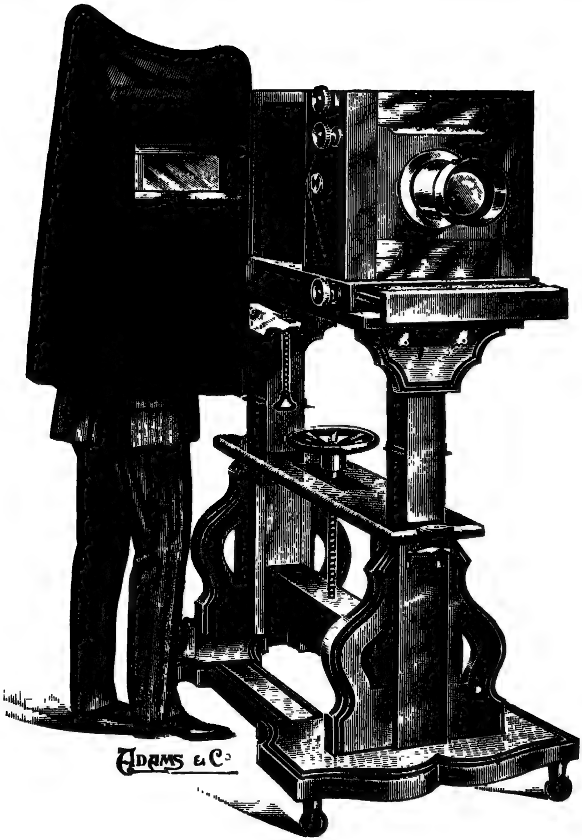
(Made by Adams and Co., 24, Charing Cross Road, London, W.C.)

In this new instrument Messrs. Adams have dealt with the reflex most thoroughly from the portrait photographer's point of view. They have recognised that a studio reflex requires to be a special type, otherwise it may remove as many facilities as it confers. The camera, which embodies the result of their labours, is an immense advance upon anything which has been offered in the past. It is, indeed, a notable contribution to the craft of camera making and designing, since the reflex construction has been cleverly applied to facilitate the operation of the ordinary studio camera.

In the Adams studio reflex the mirror is mounted (on ball bearings) vertically in the camera, so that it swings from side to side, not up and down as in the ordinary reflex. The first advantage of this system is that the force required to move it is altogether trifling, since there is no dead weight to raise, and as a result the mirror is within a degree or two of being absolutely silent in its operation. A further advantage of this position of the mirror is that the picture is viewed at the upright side of the camera, and thus can be conveniently seen, whatever the height of the camera body. A studio reflex, in which the focussing screen lies in the top of the camera, is practically of service only when working with a very low point of view, as when photographing children. With the focussing screen vertical the picture is in the best position for normal work, whilst if occasion requires that a very low point of view is adopted, Messrs. Adams meet the inconvenience by providing a mirror outside the focussing screen and inclined to it, so that the image can be readily seen when looking down from a point above, and, moreover, is seen the right way up. This attachment

can be fitted or removed in a moment for use as circumstances require.

But we have not yet referred to a further novel point, which provides a facility of the greatest practical usefulness from the studio operator's standpoint. As shown in the drawing, the focussing



screen of the camera is surrounded by a light-tight focussing hood of large size and length, such that the operator obtains ample space when standing within it. Here he can see and focus the portrait readily upon the focussing screen, and, more than that, has every other movement of the camera, such as rising front, swing of front, tilt of camera, and raising and lowering of camera immediately at

hand. Unobserved by the sitter—for the hood encloses him, as shown—he can make all the necessary adjustments, including the re-setting of the shutter and mirror after each exposure. This is done in an instant, simply by pulling a cord which hangs by the side of the ground glass. In addition to this, a window of blue glass is provided in the focussing hood, through which the operator can view the sitter directly, with colour removed and the lines to be rendered thus emphasised. The provision is a recognition of the portrait photographer's habitual practice, which will assuredly recommend the instrument to him. The sitter having been arranged and focussed on the ground glass, the operator can observe through the window the expression on the face, and make his exposure the moment he is satisfied with it; or, if the sitter moves into a fresh position, a glance at the ground glass and a touch on the focussing pinion suffice to make certain that all is in order for the production of a negative with the sitter properly placed and focussed on the plate.

As regards the general design and construction of the camera as a whole, every movement which the studio worker can require is most efficiently provided. The front has ample rack and pinion rise and fall, and a separate wide range of swinging movement The extension permits of lenses of the longest focus being used, whilst the shutter is the "Minex" focal-plane, providing exposures from $\frac{1}{4}$ to 1-150 secs, and instantly set to any given speed simply by pulling out a pinion head about a quarter of an inch and re-inserting it with a stud in one of a series of holes. Moreover, the shutter is made for use with a time-exposure valve, and thus allows of exposures from $\frac{1}{2}$ to 3 seconds being automatically given. It can also be set most quickly for time exposures when a longer period than 3 seconds is wanted. The size of the camera in the model at present introduced is whole-plate, and while a repeating back may be fitted, Messrs. Adams supply (at an extra cost) a most simple and efficient means of making two cabinet exposures on the one whole-plate. They provide the whole-plate slides with shutters divided in the middle, and opening by pulling out the two halves each from an opposite end of the slide. Thus, by pulling out one or the other half of the shutter, an exposure is made on the uncovered part of the plate, whilst, of course, for whole-plate portraits the full area is uncovered by drawing out both portions of the shutter

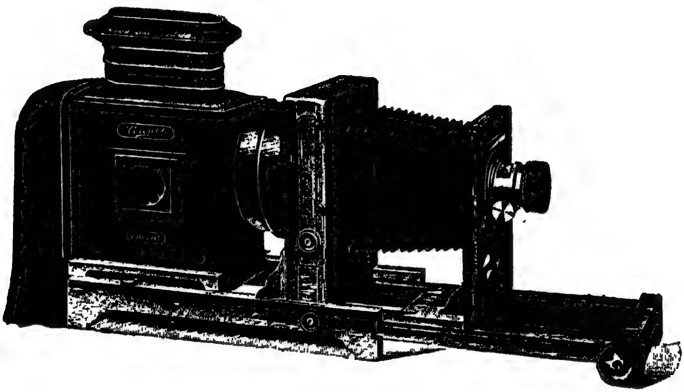
The whole apparatus, by its precision of movements, is not only a great saver of time in the studio, but equally a saver of plates, which ordinarily would require to be discarded owing to faults of focussing or placing of the sitter. We think it was Mr. Chase who gave it as his experience that in using a reflex camera for portrait work he could guarantee eleven perfect positions out of every dozen plates. With a camera of the improved construction of the Adams reflex, the yield ought to be the full 100 per cent. Apart from being a technical triumph of camera design, the instrument is one which confers immense new facilities in photographic portraiture, and we can imagine that many photographers will take an oppor-

tunity of making themselves acquainted with it at first hand by a visit to Charing Cross Road. In the one size in which it is at present made—namely, whole-plate—the price, without lens, but with one double dark-slide of the ordinary pattern, is £35. The price of the stand is £11 11s., less £1 1s., if the two are ordered together.

"CORONET," "ABBEYDALE," AND "RECORD" NEW MODEL ENLARGING CAMERAS.

(Made by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

In the new models of these enlarging cameras—the general features of which have been described in previous "Almanacs"—a radical departure is made, and one which is of very positive advan-

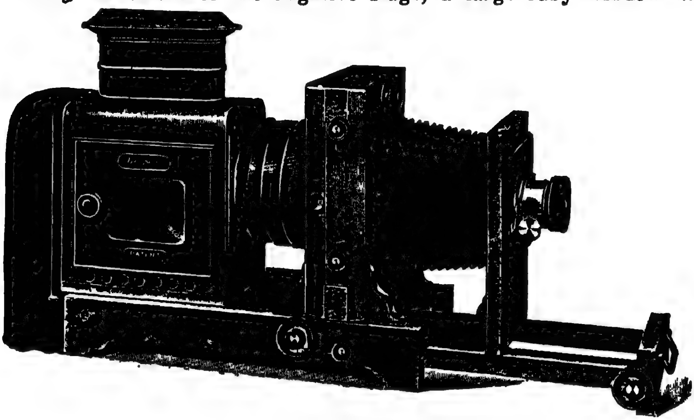


The "Coronet."

tage in practical enlarging work. In place of the customary rack-and-pinion movement of the lens front or the lamp chamber, these parts are actuated by a light chain and sprocket, consisting of a short axle on which a pair of sprockets are mounted and are turned by a large pinion head. The sprockets operate a light, strong steel chain, by which the adjustable parts of the enlarger are moved. This device, which, so far as we know, is quite new on photographic apparatus, has a number of very good points. In the first place, its use allows of the lens front being drawn right out at once. The focussing movement is rapid and extremely light (requiring no more exertion than the pinion of a moderate sized camera), and there is an entire absence of "backlash"—that is, the minutest movement of the pinion head has a corresponding effect upon the moving part of the enlarger. The last—and, in our judgment, a chief—advantage is that the focussing pinion of the lens can be placed right at the front of the extending base-

board, so that, in enlarging, the worker can place himself close to the easel, and thus examine the definition whilst he is operating the focussing pinion. This new movement is applied to the lens front of all three of the enlargers mentioned above and to the lamp chambers of the "Abbeydale" and "Record." In the case of the "Coronet," a smooth lever movement is provided for the lamp chamber. This latter enlarger, at the price of £2 17s. 6d. in the quarter-plate size, with 5½-in. condenser and without lens, is an extremely low-priced instrument, made in polished oak, with extension sufficient for making lantern slides by reduction, and with rack-and-pinion rise and fall of the negative carrier.

The "Abbeydale," also of oak, has rise and fall, and rotating and tilting movement of the negative stage, a large ruby window in

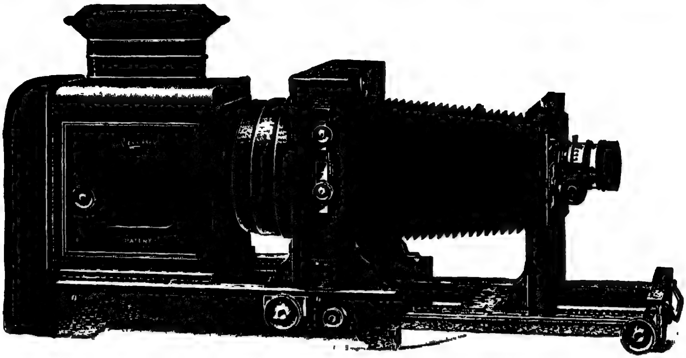


The "Abbeydale."

the lamp chamber, and long bellows extension. The price in quarter-plate size, without lens, is £4 5s. The third of the series—the "Record"—is a similar type of enlarger, but made in walnut and sold at £5 12s. 6d., again in quarter-plate size without lens. The enlargers are, of course, made in larger sizes—the "Coronet" up to half-plate, the "Abbeydale" up to 7 x 5, and the "Record" up to whole-plate.

For use with any of these enlargers, Messrs. Butcher have newly issued a particularly good pattern of baseboard and easel, in which again the "chain and sprocket" is applied—in this case for movement of the easel to and fro. The chain device has the further advantage in this case of allowing the fitment to be made so that it folds up in sections to a convenient length when not in use. The easel is hinged to turn down to the horizontal position for insertion of the bromide paper, a couple of adjustable crossbars holding the paper firmly in position, whatever its size. The back of the easel is also provided with an aperture, behind which is fitted a 3¼ x 3¼ focussing screen, and frame to take the 3¼ by 3¼ lantern

plate The enlarger thus serves equally well as a reducer for lantern slides, whilst when in use for enlarging the aperture is closed by a panel. For use with quarter-plate and postcard enlargers, the price of easel and baseboard—the former taking paper up to 15 x 12 inches—is £2 12s. 6d.; for half-plate enlargers



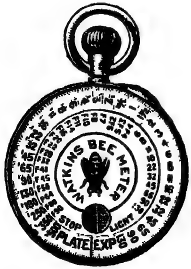
The "Record."

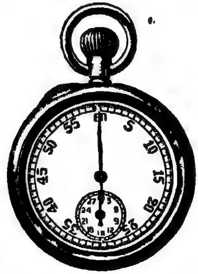
the baseboard is made in four sections, and with easel up to 23 x 17 inches, price £4 4s. Messrs. Butcher also supply enlarging lantern, baseboard and easel as a complete outfit, marked with scales to show the correct positions of lantern body, lens, and easel for any given degree of enlargement.

WATKINS' STOP-WATCH, COLOUR PLATE, AND CINEMATOGRAPH EXPOSURE METERS.

(Made by the Watkins Meter Co., Hereford.)

Although the combined exposure meter and stop-watch of the Watkins Meter Company has been supplied to individual users for





some years past, it has not been placed generally upon the market until now, owing to the inability of the makers to keep pace with

the demand. As now issued, it is quite a *de luxe* model of the well-known Watkins "Bee" meter. The stop-watch portion has a $1\frac{1}{2}$-in. dial graduated into seconds and fifths of a second. There is also a minute dial reading up to thirty minutes. One pressure on the winding key starts the fingers of both dials. A second pressure arrests the fingers, and a third pressure brings them both back

to the starting-point in readiness for the next observation. The exposure meter is fitted with a most readable ivorine scale, and is so made that any of the Watkins special scales, such as the colour-plate or focal-plane, can be used in place of it. The whole instrument is of very little greater thickness than a good English lever watch—namely, $\frac{3}{4}$ in. It does not make itself felt in the pocket, whilst, if required, the stop-watch may be used alone, its thickness being almost exactly $\frac{1}{2}$ in. The immense convenience of timing

the darkening of the sensitive paper by means of the stop-watch is, of course, one which every user of an exposure meter will appreciate, but the stop-watch is also of the greatest service in timing exposures of printing papers, times of development, etc. It is, in fact, one of the most useful accessories which a photographer can have. The price of the stop-watch meter is 35s., complete in leather snap case.

The Watkins Meter Company, Hereford, has also brought out an exposure meter specially for the use of cinematograph operators. The introduction is a special model of the "Bee" meter, modified in

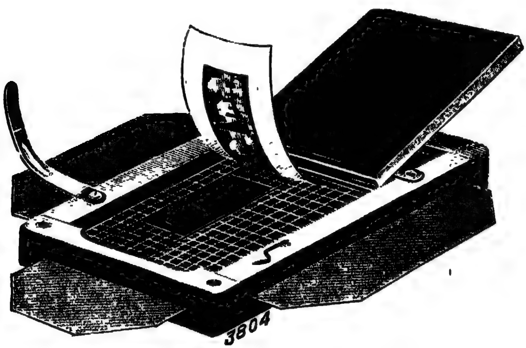
accordance with the particular requirements of cinematography, since the exposure with a cinematograph camera is largely determined by the maker of the machine, the operator producing a greater or less action of light upon the plate by the use of larger or smaller stops. Thus the Watkins meter indicates not the time of exposure, but the stop which should be used when working with a cinematograph camera adjusted to give a certain exposure.

The special model of the Watkins meter for Autochrome work has now been renamed the Colour Plate meter, the directions for its use applying also to other colour screen-plates, such as the Dufay and Paget, and also to panchromatic plates used with a screen. The special feature of the meter is the allowance it makes for the extra exposure required when the light is dull. The meter is most conveniently made in watch pattern on the precise models of the ordinary "Bee." Its price is 3s. It is, of course, only necessary to fit a different dial to it in order to be able to use it as a meter for ordinary photography.

THE "MARRIOTT" MASKING PRINTING FRAME.

(Sold by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

This is a special form of the well-known "Jaynay" non-slip printing frame, providing for the masking of the negative to any extent required without the trouble of cutting a separate mask.



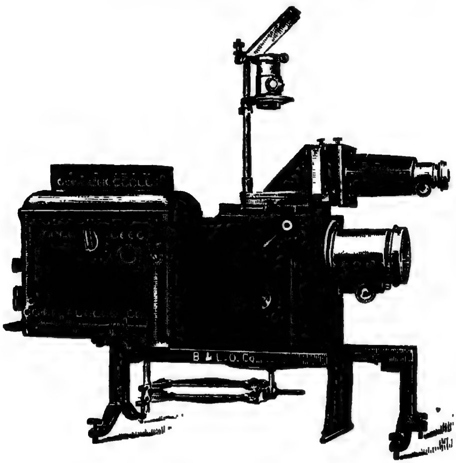
The convenience is secured by means of slots in all four sides of the frame slightly above the level of the negative. Thus, in each of these slots a strip of masking paper can be inserted, forming a mask for the negative, as shown in the drawing. The special masking paper supplied with the frame is ruled into squares to facilitate a truly rectangular open space being obtained. By turning down each masking strip on the outside of the frame the shape of the opening is preserved, but as an additional security it is an easy matter to apply a touch of strong adhesive, such as fish glue, between each strip where they overlap in the frame. The printing

frame should be a very popular one with amateur workers, since it allows of their securing a very pleasing form of print with scarcely any additional trouble. The price of the frame in quarter-plate size is 1s., in postcard 1s. 3d., and in half-plate 1s. 9d.

THE UNIVERSAL BALOPTICON LANTERN.

(Made by Bausch and Lomb, Optical Company, 19, Thavies Inn, Holborn Circus, London, E.C.)

This beautifully designed lantern serves for every purpose of optical projection, the efficient discharge of its various functions being obtained in a minimum of space and weight. Yet the



change from one form of projection to another is most rapidly made. The lantern serves for (1) projection of lantern-slides, etc., in the ordinary way. (2) Projection of transparent horizontal subjects, such as open cells containing animalculæ, chemical solutions, etc. (3) Projection of opaque objects, and (4) micrographic projection. The drawing fairly well illustrates the construction. To the left is the lantern body, containing a right-angle arc of hand-feed pattern. The chamber immediately over the initials "B. and L.O. Co." contains a mirror operated by the lever handle seen above the door of this chamber. For opaque projection the lantern body is tilted to an angle of about 45 degrees, the rays then illuminating the floor of the mirror chamber upon which the opaque object is laid. The image is projected by the large lens on the right. For ordinary or vertical projection one or other of the optical systems seen above the mirror box is simply brought over the aperture in the top of the latter, sliding upon a base plate. For micrographic projection an additional optical bed

carries the microscope, which is so mounted that it can be swung out of the way when opaque projection has to be done. Although the whole apparatus is thus so comprehensive in its powers, the adjustment required to convert it for use from one description of projection to another is a matter of a second or two only, and a continuous series of projections of different kinds can be given upon the screen without any interruption greater than that in an ordinary lantern exhibition. The price of the whole apparatus is 160 dollars (about £32), or 145 dollars (about £29) without the vertical equipment. These prices, it should be said, are exclusive of the projection microscope and additional bench therefor, the prices of which are 100 and 5 dollars, respectively. For use in colleges, or any educational institution, the instrument is as efficient a one as can be imagined.

THE CIRCLE AUTOCHROME FOCUSSING SCREEN.

(Made by Ernest Bickersteth Fry, Ltd., 110 Pratt Street, Great College Street, London, N.W.)

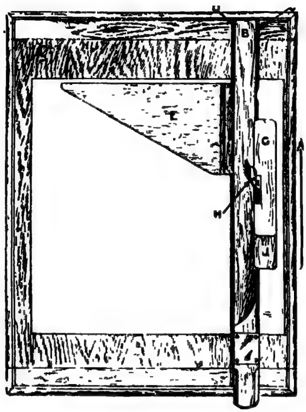
A very ingenious idea is embodied in this screen. One side is ground, or obscured, with the exception of a disc in the centre of the plate, which is left clear. On the other side of the glass, this central disc is matted, whilst the remainder is left clear. The result is a screen which shows the complete picture, but, on insertion in the frame of the camera with the plain circle towards the lens, allows of all ordinary subjects being focussed in the usual way, whilst for Autochrome work the subject is arranged in the customary manner, but is focussed upon the central disc on the side of the screen towards the rear. In short, the screen dispenses with the necessity of reversing the ground glass when making an exposure on an Autochrome plate. The price, in quarter-plate size, is 1s.; in 5 x 4, postcard, and half-plate, 1s. 6d. It should be added that the screen is of the microscopically fine grain well known as a specialty of the firm, and supplied in all sizes for cameras, backing transparencies, etc.

THE "SOHO" BEVELLER.

(Made by Marion and Co., Ltd., Soho Square, London, W.)

A piece of apparatus for the bevelling of mounts is a new introduction of Messrs. Marion's, who supply it chiefly for the purpose of producing the bevel edge on the white background sketch portraits still largely in vogue. The beveller consists of a solid oak base fitted with a clamping bar B, which holds the mount to be bevelled firmly in position. This clamping bar carries both the bevelling tool G and the set square E, each of these fitments moving parallel with each other on guides of inverted V section. Thus the mount to receive the bevel (F in the drawing) is held firmly on the board by means of the clamping

bar, and its right-hand edge, when in this position, given the necessary bevelled form by a stroke of the knife. This latter is adjustable for different thicknesses of mount, and when once set for a given thickness of board will give a perfectly clean-cut bevel at a single stroke. In bevelling the remaining three sides of the mount the latter is very quickly placed in position, since the



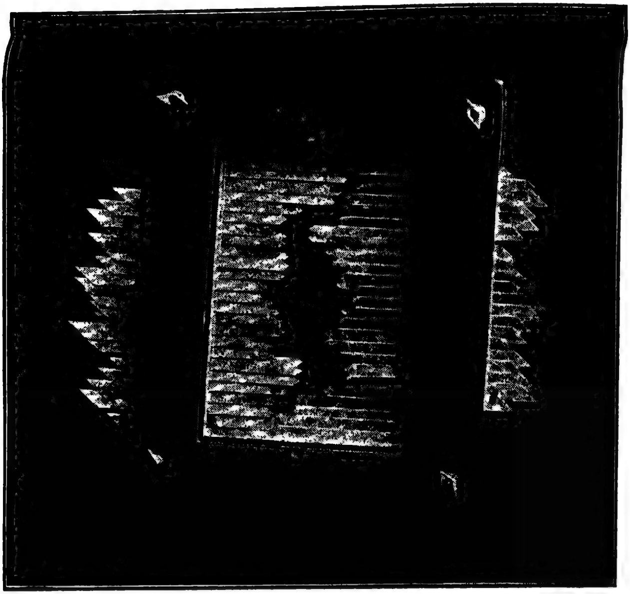
clamping bar has an attachment whereby the degree of pressure can be set and maintained through any number of applications of the bar. The mount itself is set square with the first cut by means of the right-angle indicator E. The whole apparatus is most strongly made, and will deal with mounts up to 20 ins. The price is £2 5s.

THE "BRAM" VIGNETTE PRINTING FRAME.

(Made by Wahltuch, Smith, and Co., 30, Chapel Street, Salford, Manchester.)

Numerous as have been the expedients recommended for quickly making vignetting masks, it has been left to Messrs. Wahltuch and Co. to devise an appliance which provides a rapid and permanent means of producing any given shape and (within its limits) any size of vignetting mask in a few seconds. The "Bram" apparatus consists of a frame of size to take a half-plate negative. Within the frame, so that they come about an inch from the negative, are two series of narrow overlapping metal strips. These can be slid to and fro so as to cover entirely the half-plate space, or to yield an aperture which may be of any desired size or shape, according as the strips are moved apart to a greater or less distance When a suitable size of mask has thus been formed, it is held firmly in

place by screwing down a covering frame in which ground glass is mounted. *The light which thus reaches the negative is diffused, and, in conjunction with the serrated nature of the aperture in the mask, yields* exceedingly soft vignettes when printing by artificial



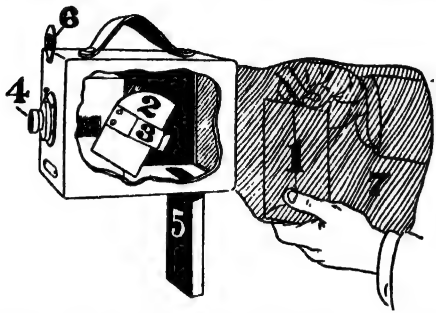
light on bromide or gaslight paper. The apparatus is one which is most useful in still further enhancing the value of development papers in the making of artistic portraits. Price 10s. 6d.

THE MANDEL-ETTE ONE-MINUTE CAMERA.

(Made by the Chicago Ferrotype Co., 12, St. John's Lane, Liverpool.)

To the series of cameras tor direct while-you-wait portraiture an addition has been made in the shape of this very simple instrument taking portraits on cards of a $3\frac{1}{2}$ by $2\frac{1}{2}$ inches size. These are coated with a special emulsion, and are developed and fixed in one operation in a solution which is contained in a vertical tank attached to the camera. In use, the apparatus is of the most simple kind, and is free from any mechanism liable to get out of order. As shown in the drawing, a pack (1) of the sensitive cards is introduced into the long sleeve at the back of the camera, and the wrappings removed. The pack is then placed in a hinged receptacle (2), which is pushed forward and brings the front card into

the position for exposure. In taking the portrait the camera requires to be firmly supported on a tripod, as the time of exposure varies from ½ to 5 seconds, according to the strength of the light. After exposure the hinged receptacle is simply turned down slightly, the exposed card removed and thrust into the tank of combined developer and fixer (5). Here it is fully developed within the space of about a minute, and then requires only a brief washing. The camera is fitted with a single lens and simple shutter for time exposures and with a direct-vision finder. Although of the simplest



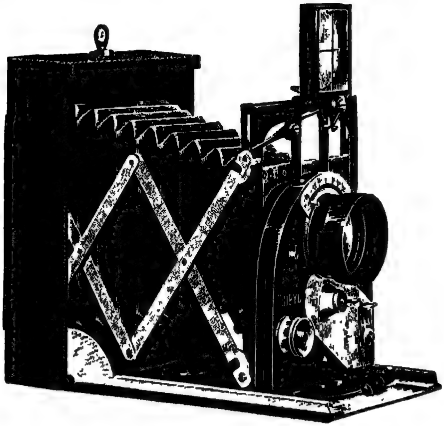
description, it is a quite practical instrument with which a boy or a girl can obtain portrait and other photographs with no more experience than can be obtained in a few minutes, and by one or two trial exposures.

NEW MODEL "SIBYL" FOLDING HAND CAMERAS.

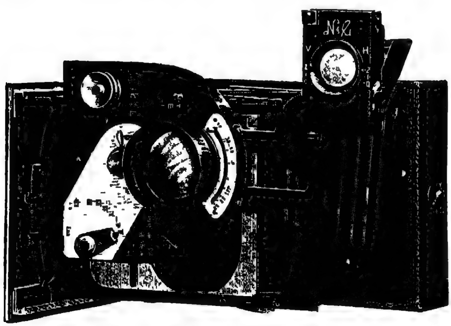
(Made by Newman and Guardia, Ltd., 17-18, Rathbone Place, Oxford Street, London, W.)

Perfect as we have been accustomed to regard the various models of "Sibyl" hand camera which have emanated year by year from the N. and G. factory, it must be confessed that the 1914 "New Special" Sibyl embodies certain most positive improvements. Though these are of a minor character—the design of the camera remains unchanged—yet they afford certain very distinct conveniences in practical work. In the first place the lens is provided with a sliding hood, which affords the degree of shading of the glass which lens makers of late years have discontinued providing. The hood is simply drawn forward when opening the camera, and pushed back when closing it. As regards the focussing arrangements, a depth scale is now provided showing the stops necessary for a given degree of depth when focussing on the various distances. In the case of workers using both dark-slides and film-pack or changing-box, a further facility is provided in that the necessary alteration in the focussing bed is indicated on the front of the baseboard, the letters "D S" showing when the focussing bed is set for dark-slides, and "B" and "F P" indicating the setting for changing-box and film-pack.

Another very nice refinement is in connection with the finder. This, as the "Sibyl" user knows, is provided with a rising lens, the movement of which corresponds with the rise of the lens on the camera proper. When the camera is closed the lens must be



placed at its lowest point, but in the previous models the finder might be folded with the lens raised. This difference has now been removed, the finder lens automatically lowering itself when the finder is closed. Thus it is impossible on closing and reopening the

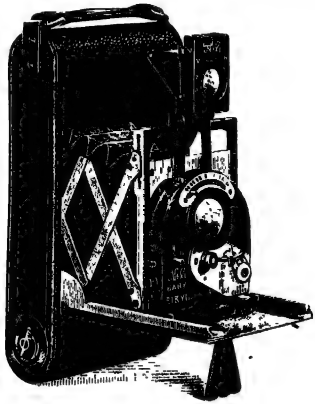


camera for the lenses of camera and finder to be out of correspondence. A further very noteworthy improvement is the provision of rise of front the landscape way of the plate, whilst the shutter has now the extra speed of 1-150 sec.

The attachment of the finder is such that it is a very easy matter (of a few minutes only) for the makers to replace the camera

pattern of finder by one of the direct vision type, in cases where this latter is preferred by the user. With all these improvements in what previously was an exceedingly well-designed instrument, it is no wonder that the makers of the "Sibyl" should congratulate themselves that they have preserved the original small size and weight of the camera and have not in any way sacrificed its extreme facility in use. The $3\frac{1}{2} \times 2\frac{1}{2}$ ("New Special"), Sibyl with Zeiss *f*/4.5 Tessar is sold at £15. In the quarter-plate size (designated "New Ideal") the price is £19.

The roll film "Sibyls," of which a particularly choice model is the "Baby" roll film Sibyl, likewise shares in the improvements, or, at any rate, in the majority of them, which we have described above. In the case of the "Baby" roll-film Sibyl the new model



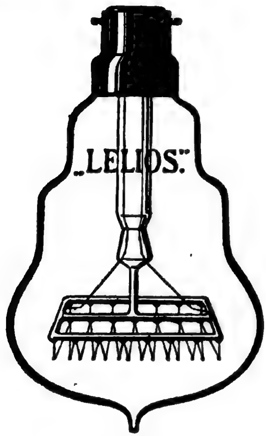
now takes a larger picture, $1\frac{5}{8} \times 2\frac{1}{2}$ inches, and the whole camera is an extremely beautiful example of refined mechanical workmanship applied to its particular purpose. Messrs. Newman and Guardia are admittedly experts in the design of self-adjusting contrivances, and a very good example of this is the spool chamber of the "Baby Sibyl," the spool of film falling into a pair of somewhat L-shaped grooves, in which it automatically finds its bearings, yet from which it is instantly removed without touching a catch or spring of any description. With *f*/4·5 Tessar, the price of the Baby roll-film Sibyl is £13 13s.; in $3\frac{1}{2} \times 2\frac{1}{2}$ size the roll-film New Special, £17, and in quarter-plate (roll-film New Ideal) £21.

LELIOS INCANDESCENT ELECTRIC LAMPS.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

A new pattern of incandescent metallic filament lamp has been introduced by Messrs. Sichel, under this name. The distinguishing feature of the lamp is the arrangement of the metal filament: the latter runs zigzag fashion in a plane which is horizontal when the lamp is vertical. Thus the lamp throws the bulk of its rays directly

upwards or downwards, according to its mounting. The result is that for printing purposes, where the negative is placed directly under or over the lamp, the gain in speed of exposure is very considerable; comparing the "Lelios" lamp with one of the same power, but of vertical arrangement of the filaments, we found that the exposure for a gaslight paper with the "Lelios" was from one-



third to one-quarter the time. The lamp is thus a very distinct improvement, and particularly suitable for box printers used for gaslight papers. A couple of the lamps will evidently do the work of half a dozen or more of the ordinary pattern. The diffusion of lighting caused by the special shape of the filament area should also fit the "Lelios" lamp specially for arrangements of enlarging without a condenser, a series of the lamps being placed behind the negative with the filaments parallel to the latter, and the necessary diffusion secured by a ground glass screen between the two. Even for ordinary domestic lighting in photographers' reception rooms the lamp has equally positive advantages, the light being thrown in the direction in which it is wanted. The lamps are supplied for voltages from 70 to 240, of power from 16 to 32 c.p., and at prices from 3s. 9d. to 5s. 3d.

THE BEAUFORT BORDER PRINTING FRAME.

(Sold by John J. Griffin and Sons, Ltd., Kingsway, London, W.C.)

A simple decorative design around the print and upon the paper itself has come largely into favour of late, and has naturally led to various devices for securing the effect with the minimum of trouble. We can hardly believe that any can be simpler or more expeditious in use than the new frame designed by Mr. J. W. Beaufort and placed upon the market by Messrs. Griffins. It consists of a stout printing frame, very much of the ordinary pattern, save that the

pressure back is permanently hinged to one end of the frame. The latter is fitted with a double glass front, the outer glass supporting the negative in the frame and the inner glass (which simply lies upon the outer) having a space cut from it to take a half-plate or other size of negative. The inner glass thus keeps the negative in its proper position without the aid of any paper binding or similar means, which would interfere with the working of the Beaufort method.

The border design is supplied printed (in negative) on a mask of paper which just fits the frame. The design is in white on a black ground, and is so placed upon the mask that it comes in a suitable position around the portrait. The whole process thus resolves itself into the absurdly simple operation of laying the negative within the space cut out of the inner glass, laying the design border mask in the frame, and upon this latter the sheet of sensitive paper, which may be up to 12 x 10 inches. The one operation then of exposure to light—either daylight for print-out paper or artificial light for bromide or gaslight—prints both the portrait subject and the surrounding design on the paper. The back of the frame is made of a pattern which is suitable for bromide printing, and at the same time makes the frame an efficient non-slip pattern for print-out papers. The frame is provided with a couple of bolts, which serve to clip the border mask against the glass, and so prevent the latter moving in respect to the negative whilst making a series of prints.

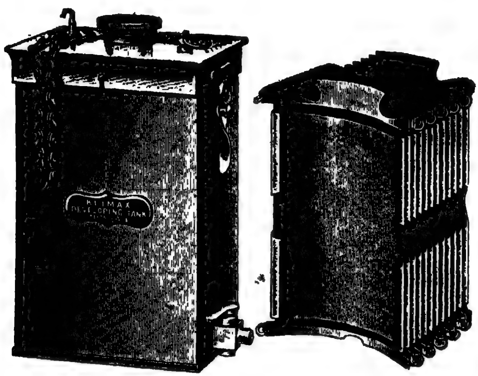
Of course, it will readily occur to any photographer that the method, as we have described it above, makes no provision for the different densities of negatives or for the different depths which the border design may be desired to be. This adjustment, however, is very readily made simply by the use of a number of thin white paper masks of the same size and shape as the black border masks. One or more of these, as may be required by the density of the negative, are inserted in register with the border mask, and, like it, are held in place by the bolted portion of the pressure back. The whole device is of the simplest character, but, as we have found, is capable of producing most satisfactory results, and of enabling the photographer to introduce a great variety of border decorations at small expense of time and trouble. Such prints may be those on stout paper placed, without mounting, in a folder, or they may be on paper of thinner substance, and be attached to a suitable mount. The price of the frame, complete with three assorted borders, is 17s. 6d. Additional borders are supplied, price 1s. 6d. the set of three, whilst extra glasses for the holding of negatives cost 2s. 6d. each.

THE "KLIMAX" FILM PACK DEVELOPING TANK.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

In this tank for the daylight development of the films from film packs the novel feature is the ingenious form of rack which consists of a series of stout sheaths of nickelled metal secured together

so that they form a long chain, yet fold one on the other so as to admit of easy and rapid insertion into the tank. In inserting the film the block of linked sheaths is placed in front of the worker and a film inserted in every alternate sheath, the block being then turned round and the remaining sheaths filled. This can be done quite readily in the dark, the grooves of the sheaths forming a sufficient guide for each film. This done, the whole block is placed in the tank of developer, the light-tight cover put on and clamped down, and the batch of film left to develop. At the end of the time the developer can be drawn off, the films washed by pouring water through the tank and the fixer then poured in. When working in a dark-room, as many will do even



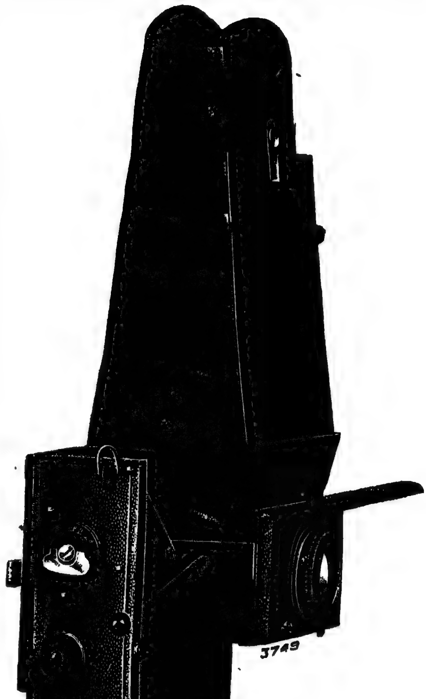
when using such a tank as this, the block of sheaths is removed and transferred to a fixing tank. The tank is exceedingly well made in nickelled metal, and is supplied in four sizes—vest pocket, price 10s. 6d.; $3\frac{1}{2}$ by $2\frac{1}{2}$, 12s.; quarter-plate, 12s. 6d.; and post-card, 16s. The quantities of developing solution required for these sizes are 15, 24, 30, and 47 ozs. respectively. Extra chains of twelve sheaths are supplied at prices from 6s. to 10s., whilst the tanks can also be used for the development of plates by means of racks (holding six), supplied at from 2s. to 3s. 6d.

THE NEW HOUGHTON FOLDING REFLEX CAMERA.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

Of late years many designers of cameras have interested themselves in reflex instruments of the folding type. Messrs. Houghtons themselves were early in the field with a camera of this description, but the present instrument is an entire departure from that design, the drawback to which and to other patterns of folding reflex was the time taken to set the instrument ready for use. In the present model there is absolutely but one movement

required to change the camera from the closed to the open position. Holding the camera by its carrying handle, a nickelled spring is released, the lens front of the instrument then drawn forward—it almost falls of itself—and the camera is then ready for an exposure with the hood fully raised, and the mirror in the set position. Closing takes a little longer, as the hood requires to be folded in place within its covering plate, but even this operation takes only a second or two. The shutter is a very convenient pattern of focal-plane with speeds marked from 1-10 to 1-1000, and ready adjustment for time and bulb exposures. Release is made by pressing down the small metal stud, whilst the mirror is raised after an exposure by pressing down the milled head, both seen below the winding key. The extremely smooth and silent action of the mirror deserves special commendation. The mirror acts independently of the shutter, and thus the camera can be used, held at the eye level, for ordinary work as with a folding focal-plane. In the only size in which it is made—namely, quarter-plate—the camera is fitted with lens of $5\frac{1}{4}$ ins. focal length, supplied in a focussing mount sufficient for objects as close as 6 ft. It can take large-aperture lenses, such as the $f/4{\cdot}5$ "Tessar." As regards portability, the camera, when closed, does represent a very compact instrument; its thickness is under 3 ins., whilst it measures $6\frac{1}{2}$ by $6\frac{1}{2}$ ins. The construction of a reflex of folding pattern involves in most cases certain limitations, such as lesser extension and absence of rise of front, but there are plenty of people who are ready to sacrifice these for the undoubted facility of the reflex principle in small bulk. These, we feel sure, will welcome the Houghton instrument as a most admirable design of its kind, and particularly in regard to its very rapid opening and closing.



Complete with three double dark-slides and $f/4{\cdot}5$ Zeiss "Tessar" the price is £21 5s.; with "Ensign" $f/5{\cdot}5$ anastigmat, £18 5s.

A PHOTOGRAPHER'S COMPASS.

(Sold by F. G. Phillips, 12, Charterhouse Street, London, E.C.)

In this little accessory the indication of the compass needle is used to show the time of day at which a subject is lighted in the best way, presumably somewhat to one side or other of the camera, and behind it when the lens is pointed directly to the subject. It is very simply used by pointing the ring of the compass in the direction of the object to be photographed. The dark end of the needle then indicates the hour, morning or afternoon, at which the

object is best lighted. Where an object can be placed in any position for photographing the operation is the reverse: the compass is turned until the dark end of the needle points to the hour at which the exposure is being made, and the subject is then placed in the direction of the ring. The price of the compass is 2s. 9d.; the drawing shows its full size.

AN AUTOCHROME DAYLIGHT DEVELOPMENT DISH.

(Made by Newman and Guardia, Ltd., 17-18, Rathbone Place, Oxford Street, London, W.)

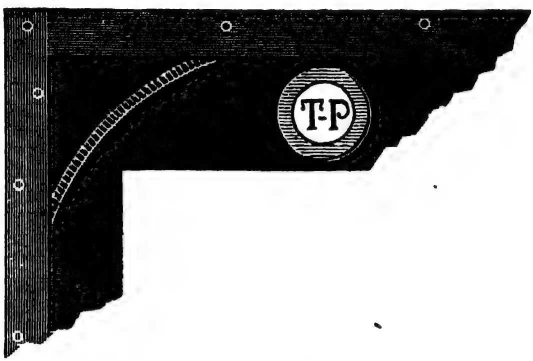
A little piece of apparatus, which will doubtless be greatly appreciated by Autochrome workers, is this development dish, by which the Autochrome plate can be immediately developed and reversed without resort to a dark-room. The dish consists of a flat tray, taking a half-plate, and provided with a light-tight cover through which, by a curved light-tight tube, the developer is introduced. The solution remains on the plate until the dish is greatly tilted to one corner, when it flows off over a small weir almost to the last

drop. After a brief rinse with water the reversing bath is applied in the same way, and the remaining operations can then be carried out with the lid removed. The dish is mounted on three V-form feet, by which the requisite rocking movement can be given during development, etc. It is strongly made in nickelled brass.

THORNTON-PICKARD ENLARGERS.

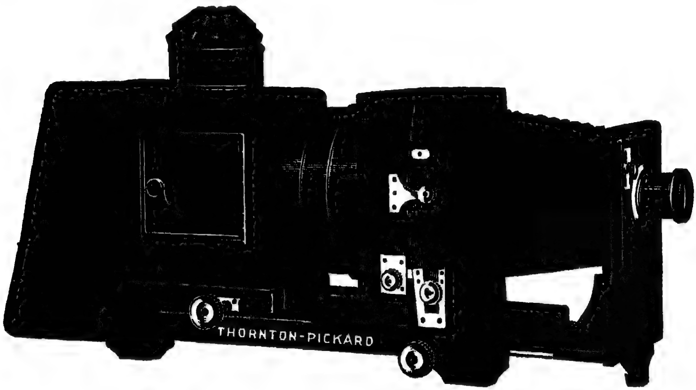
(Made by the Thornton-Pickard Manufacturing Co. Ltd., Altrincham.)

In their models of enlarging lanterns for the forthcoming season the Thornton-Pickard Company have introduced a number of improvements which further exalt the usefulness and convenience of these instruments. Chief among them we should mention a most ingenious and simple device whereby sharp focus of the



negative on the enlarging easel is readily obtained without resorting to the trouble of inserting focussing plates or similar devices in the negative carrier. The latter is, in fact, provided with a permanent line transparency mounted so that it occupies the same plane as the surface of the negative. It is projected upon the screen, and is there focussed when arranging the size of the enlargement. This little device is fitted to all the Thornton-Pickard enlargers, and will undoubtedly contribute to their popularity, as it relieves the amateur worker from much of the difficulty in securing perfectly sharp enlargements particularly of dense negatives. In regard to the individual enlargers, the "Artist" is now issued in quarter-plate size at the low price of £4 7s. 6d. complete with Beck $f/7{\cdot}7$ anastigmat. Moreover, the lantern is fitted with rack and pinion movement, the lantern body is of larger size and improved shape, and rack and pinion movement of the revolving negative carrier is supplied. A foot support for the lens front is an additional improvement as contributing extra stability to the extended enlarger. A further good feature, now adopted in all the T.P. enlargers is the making of the feet of

inverted V section, so that the purchaser can readily provide an enlarging bench by nailing a couple of V section strips to a board. The enlarger can thus be moved to and fro along them strictly at right angles to the easel. Progressing from this cheapest of the enlargers, the full series include the M.C.C. No. 3, made in oak; the "Special Ruby," in mahogany; the M.C.C. No. 6, in oak; and the de luxe model of this latter made in teak and brass bound, and including every movement and adjustment which can be demanded in an enlarging lantern. Of these, perhaps the "Special Ruby," which we illustrate, is the enlarger which will most appeal to would-be purchasers of a thoroughly high-class instrument. In quarter-plate size, with portrait lens, it costs £6, and is obtainable in sizes up to 7 x 5 inches (9-inch condenser). In the quarter-plate size it



takes 5 x 4 and postcard negatives. The brass-bound negative stage has rack-and-pinion adjustments for rise and fall, rotation and tilt. There is rack movement of the lantern-body, rise of lens, and a large ruby window in the lantern. The whole outfit is one which embodies both extreme convenience and sound, strong workmanship.

THE "DODO" TELEPHOTO LENS.

(Sold by Captain Owen Wheeler, Strathmore, Princes Road, Weybridge.)

Captain Wheeler, as our readers doubtless know, has always been an advocate of comparatively short camera extension in telephoto work. His own experience has led him to prefer reasonably great magnification to the risks of vibration which are inherent in the employment of a long-extension camera when working at a more moderate degree of magnification. In the new lens this system is, to a large extent, embodied, the instrument being designed for use on hand-stand cameras of the average pattern and of 5 x 4 or half-plate size. But the chief attraction which the new lens possesses is the extremely simple method in which it is used

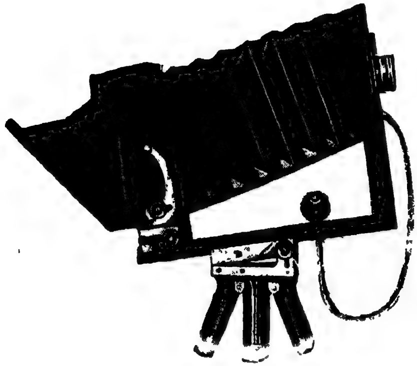
for securing magnifications from 4 to 13. As the telephoto attachment is designed for use with a positive of about 5 or 6 inches focal length, it will be seen that this range covers equivalent focal lengths from 20 to 65 inches. This is secured by the use of two negative lenses, each mounted in a separate cell. The two cells are so made that either or both may be screwed into the back of the mount, and it is the matter of only a few seconds to make the necessary change according as a given magnification is required. Captain Wheeler further secures equal rapidity in the adjustment of the camera extension by supplying with the lens a simple form of indicator, consisting of a strip of boxwood in which slides an inner strip of ebonised wood. The boxwood is marked at ten different points by lines which indicate the place to which the blackwood bar must be drawn out in order to provide a given magnification. Each marking also indicates which of the two negative elements is to be used behind the positive lens. The operation of taking a telephoto negative thus becomes enormously simplified. For example, supposing that we want a magnification of eleven times, the black strip is simply drawn out to the mark 11, when the total length of the indicator is the distance which the ground glass must be from the lens-panel. The marking also indicates that for this magnification both the negative elements should be used. Focussing is done by means of the rack and pinion, which determines the separation of the positive from the negative—by far the most certain and expeditious plan in telephoto work. As regards the optical qualities of the new lens it should first be said that the tele-negatives are those of the regular series manufactured by Messrs. Ross, and may be used with any good positive lens, and particularly with the Ross "Homocentric." In our own trial of the objective, we have found that at the lower magnifications (4 to 6) the covering power over a 5 x 4 plate is excellent and exquisitely sharp. At greater magnifications the plate covered is much larger, whilst the definition remains exceedingly crisp. Even when working at such a comparatively high power as 13 or 14. details, such as the pattern of lace curtains in a distant window, were exceedingly well rendered, and we venture to say that were it not for the large scale of the images photographers would hesitate to say that they were taken with a telephoto lens. The "Dodo" is made in two sizes, No. 1 for positive lenses from 5 to 5½ inches focal length, and No. 2 for 6-inch positives. The price in each case of the tele attachment and the camera scale is £7. The "Dodo" is supplied ready fitted with "Homocentric" lens at an extra charge only of the list price of the lens; in the case of other objectives, which require adaptation, the cost is from 3s. 6d. to 5s.

THE EASTMAN HOME PORTRAIT OUTFIT.

(Sold by Kodak, Ltd., Kingsway, London, W.C.)

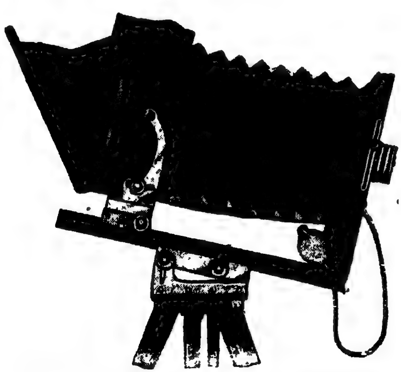
This outfit is designed specially for the use of professional photographers making a feature of at-home portraiture. It consists of a half-plate camera, tripod, 9 double slides, background and reflector,

with carrier for each, the whole specially designed to pack into two small cases. Very thorough provision is made for the difficulties to be overcome in portrait work away from the studio. The camera is fitted with a focussing mirror, which allows of the



Home portrait outfit, showing upward tilt.

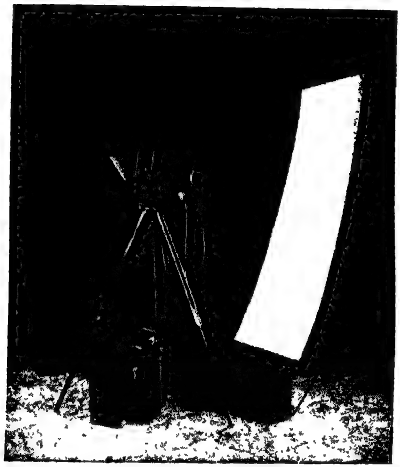
picture being seen the right way up: there is a special rack and pinion movement for upward and downward tilt of the camera. The tripod (very rigid) is stayed so that for practical purposes



Home portrait outfit, showing downward tilt.

it becomes one of the solid pattern. The points are rubber-tipped, and thus relieve the photographer from the fear of doing damage to the polished floors of rooms where he may have to work. An all-metal "Silento" shutter with special pneumatic attachment for

holding it open for any time whilst focussing is another special feature. The background is mounted for ready raising or lowering, and the reflector may be similarly adjusted as well as tilted at any angle. Fitted with a Cooke $f/5{\cdot}6$ lens of $8\frac{1}{2}$ inches focus, it will be seen that the whole outfit marks extreme care on the part of the designers for its special purpose. Complete with "Cooke" lens, "Silento" shutter, 9 double plate holders, extra front lens-board,



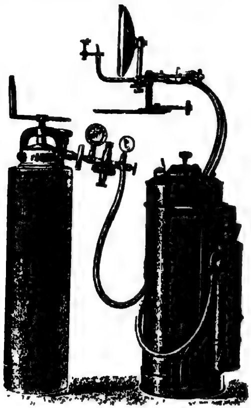
tripod, background and carrier, reflector and head block, and two special carrying cases, the price of the outfit is £22 2s., or, without lens and shutter, £14 14s.

THE "SPECIALIST" PORTABLE OXYGEN GENERATOR.

(Sold by Ernest Bickersteth Fry, Ltd., 110, Pratt Street, St. Pancras, London, N.W.)

In this apparatus a special material is used for the generation of oxygen gas without application of heat further than the use of a little igniting mixture to the "Oxygenite" material. The latter then gives off a steady stream of gas. The apparatus consists of a cylindrical shell containing a central tube in which the gas is washed. The generation of the gas proceeds within the cylinder, which is made capable of withstanding the pressure produced by its proper charge with an ample margin to spare. It is reduced to working pressure by one of the customary regulators, and is employed with a blow-through or mixed jet in exactly the same way as oxygen from a cylinder into which the gas has been

compressed. The generator is made in four sizes, producing oxygen to the volume of 7, 10, 18, and 35 cubic feet respectively, the



prices being £7 10s., £8 5s., £11 10s., and £21 10s. The drawing shows also an acetylene generator, which, with all other requisites for lantern work, is supplied by Messrs. Fry.

THE SINCLAIR "MINIATURE UNA" CAMERA.

(Made by James A. Sinclair and Co., Ltd., 54, Haymarket, London, S.W.)

Those who set lightness and portability as chief essentials in a camera—and the popularity of vest-pocket instruments shows that they are many—will welcome the introduction by Messrs. Sinclair of their well-known "Una" camera in the $3\frac{1}{2} \times 2\frac{1}{2}$ inch size. While the new instrument is of extremely compact dimensions (about $5 \times 5 \times 3\frac{1}{2}$ inches), it has also all the wide range of movement in the way of rise of front, extension, etc., of the other "Una" cameras. The extension is 9 ins., the lens can be raised over $1\frac{1}{2}$ ins. and swung whilst at any height, and the camera is fitted with rotating back. It is a choice little instrument, embodying the fine workmanship of the other "Unas," their good design, and great rigidity. It is supplied only as a standard outfit, complete with lens, shutter and finder. The shutter is the Sinclair "Accurate," with the real speeds, as certified by the National Physical Laboratory, engraved on it. The finder is also the "Sinclair," scaled to indicate the actual picture for different degrees of the lens rise. The lens is either the Ross *f*/6·8 "Homocentric" of $4\frac{1}{4}$-inch focus, the Zeiss *f*/4·5 "Tessar" of $4\frac{3}{4}$-inch focus, or the Zeiss "Double Protar." In the case of the last-named lens the price of the outfit is £17 10s., including two separate focussing scales, three double plate holders, level, etc., complete in leather case. With the "Homocentric" the price is £14 10s., and with the "Tessar," £15 15s.

THE "AURORA" STUDIO ARC LAMP.

(Made by the Tress Company, 4, Rathbone Place, London, W.)

This two-pair arc lamp is of an entirely distinctive type of construction. It is automatic in use, the arcs remaining in position by a self-compensating magnetic mechanism mounted immediately behind the plate supporting the carbons. An exceedingly intense light is given by the lamp. The makers state it as 4,000 candle-power; at any rate, the lamp suffices fully for studio portraiture of groups and single fixtures by artificial light. The method of using is shown in the drawing, the lamp being placed behind a

screen of tracing cloth which carries a couple of adjustable curtains. The lamp itself, or rather its stand, needs only eight screws to fix it to the floor of the studio, or can be attached to a baseboard, on which the operator, if he requires, may move it from one end of the studio to the other. Although issued complete at the very low price of £3 19s. 6d., the lamp is a thoroughly satisfactory article, and one which should further greatly popularise the use of electric light in the studio.

THE "PYKET" MIRROR FOCUSSING HOOD.

(Made by F. Whitehead and Co., Picket's Street Works, Balham, London, S.W.)

This is a special form of focussing hood which can be attached to any camera. It folds within the space of an ordinary focussing hood, but it is of a distinct pattern from this latter, since it is fitted with a mirror in which, looking down the hood, the photo-

grapher sees a reflected image of the picture upon the focussing screen. This is seen the right way up. The hood is certainly more convenient in use than the ordinary pattern, which requires to be held at arm's length. With the "Pyket," the worker can hold the camera pressed against his body and still view the image upon the focussing screen. The hood will be supplied in the customary sizes and of register to correspond with that of any make of camera. The price in quarter-plate size is 5s.; in half-plate, 7s. 6d.

THE ALDIS F/4·5 ANASTIGMAT.

(Made by Aldis Bros., Sparkhill, Birmingham.)

In this lens Messrs. Aldis have secured the most exceptional covering power and definition at the large full aperture of *f*/4·5. The lens, which we have examined, is one of 5¾-inch focal length, a focus which is selected by the makers as the best average for a quarter-plate, although they can supply also in 5¼-inch focus for those who prefer it. The lens affords most critical definition, not over the quarter-plate only, but throughout a full half-plate, and this without stopping down. It is certainly an instrument which may be termed a universal objective, of high speed for portrait work or the most rapid hand camera exposures, and serving also as a wide-angle lens on a much larger plate. The photographer of architecture, who usually has to raise the lens considerably on the camera front, may be certain of obtaining full definition over the whole plate without sacrificing rapidity of exposure. Messrs. Aldis have issued postcard reproductions of a line test object photographed by the lens in which the critical definition is exceedingly well shown. For its high performance the lens is issued at a remarkably low price, namely £4 for the 5¾-inch; £3 10s. for the 5¼, and £5 for the 6¾ or postcard size.

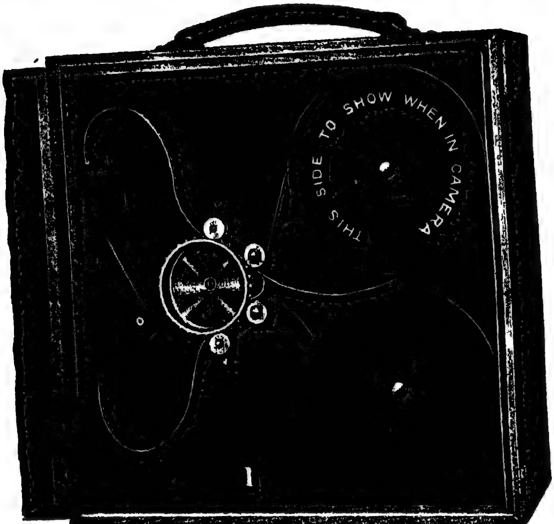
A convenience, which all lens users will appreciate, is a further new introduction of Messrs. Aldis. It is the "spring lock iris," the leaves of the iris diaphragm being so mounted that the ring of the iris snaps exactly into position for each stop value marked on the lens tube. In stereoscopic work this is a particular advantage, since it ensures each lens of the pair being set to exactly the same *f* number. Also, when using a lens on an enlarger, it is often a convenience to be able to ascertain in the dark the extent of stopping down simply by noting the number of clicks which the diaphragm rim makes when removing it from the position of full aperture. The improvement can be fitted to any Aldis lens at the additional price of 3s. 6d.

THE "ENSIGN" DAYLIGHT-LOADING CINEMATOGRAPH CAMERA.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

This cinematograph camera marks the introduction of this type of instrument at a popular price; also of the reduction of the manipulation to operations of the simplest order. In introducing it Messrs. Houghtons, Limited, have evidently had before them the

amateur worker to whom the practice of taking cinematograph pictures opens up a new field of photography with endless opportunities for fascinating subjects. The camera inself is not an unduly bulky piece of apparatus: it measures $9\frac{1}{2}$ x $9\frac{1}{2}$ x $4\frac{3}{4}$ ins.; that is to say, its size is little more than that of a whole-plate square-bellows pattern of field camera. Its weight, when loaded with 100 ft. of film, is under 8 lbs. The lens is the Zeiss Tessar of 5 cm. (2 ins.) focal length and of aperture *f*/3·5. It is mounted in a focussing tube providing adjustment for objects up to 5 ft. from the camera. In the case, however, of the majority of sub-



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jects the lens, when set at infinity, will give sharp pictures of all distances. The focussing tube allows of the camera being used on subjects near at hand, such as portraits. The lens is fitted with iris diaphragm graduated from *f*/3·5 to *f*/16. The film mechanism is of an extremely simple kind, the film being threaded from the delivery spool under two guide rollers on to the sprocket wheel, thence through the "gate" and back over two further guide rollers to the collecting spool. The sensitive film is supplied on metal spools with an additional 5 ft. of black paper wrapping at each end, which allows of the film being loaded into and removed from the camera in full daylight.

The camera, of course, is used on a tripod, and one of substantial construction is necessary. Messrs. Houghton supply one of suitable build for about 30s., or one of the more elaborate pattern, with

mechanical head for revolving and tilting, from £3 15s. to £5. In the use of the camera practically the only thing to be learnt is correct turning of the winding handle. A little practice with the unloaded camera will show the rate at which the instrument is most advisedly worked. The maximum speed is about 120 revolutions of the handle per minute, an average speed 96 revolutions per minute, and the lowest permissible speed 72 turns per minute. As regards exposure, the range of apertures of the lens allows of the running of the instrument to be suited to different subjects and strengths of light. For placing the subject on the film a direct-vision view-finder is provided. The whole apparatus is supplied in a polished mahogany body, which contains the lens and winding handle when these are not in use. The price of the apparatus, complete with Zeiss Tessar lens, is £11 10s., or, with indicator showing the length of film run off, £12 5s. The film itself, of standard width, is supplied in spools (daylight loading) of lengths from 25 ft. to 100 ft., the price of the former being 5s. and of the latter 17s. 6d. These prices include cost of development by the makers, Messrs. Austin Edwards, Limited, Warwick, by whom positive film is printed from the negative at a price of 2d. per foot run.

FULL-VIEW CELLULOID PLATE-MARKING FRAMES.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

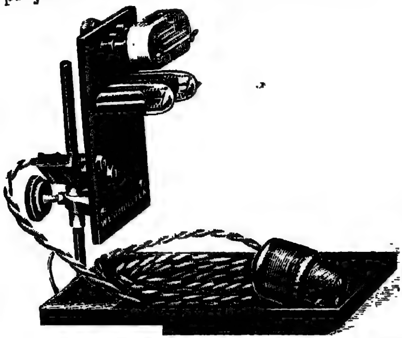
A most convenient appliance for the professional photographer, or indeed for the amateur worker, is a new introduction of Messrs. Sichel. It consists of a couple of stout celluloid sheets firmly secured together by a metal hinge. The aperture in one registers with a raised portion on the other, so that on inserting a print between the two a plate mark is given to it on the most moderate pressure. While any dry-mounting press may be used, such as the Morgan, pressure with the hand amply suffices to give a deep plate-mark in the case of papers of average weight. The special advantage of the appliance is that the print remains in full view (through the celluloid) the whole time, and the plate-mark can thus be adjusted to the greatest nicety to the subject, which is usually a portrait printed from the negative with a mask of suitable size and shape. Messrs. Sichel supply the frames in all customary sizes, and with any required size or shape of aperture.

THE "WESTMINSTER" NERNST LAMP.

(Made by the Westminster Photographic Exchange, Ltd., 119, Victoria Street London, S.W., and 111, Oxford Street, London, W.)

This self-lighting Nernst lamp for enlarging and projection lanterns is a thoroughly well-made piece of apparatus, all the metal work being brazed or folded over so that it resists the heat of the lamp in use. The back is of fireproof material. The lamp, which is supplied for any voltage (though it is best used at one of about 200) is simply connected by inserting a plug in an ordinary lamp-holder. On switching on, with the resistance of the lamp cut out, the filament immediately glows and reaches its full brilliant incandescence in about half a minute, after which the resistance may be

put in. The filament is small, about $\frac{3}{4}$ in., and this, coupled with the enormous brightness of the light, makes it a very suitable one for lantern projection, as well as for enlarging, the absolute con-

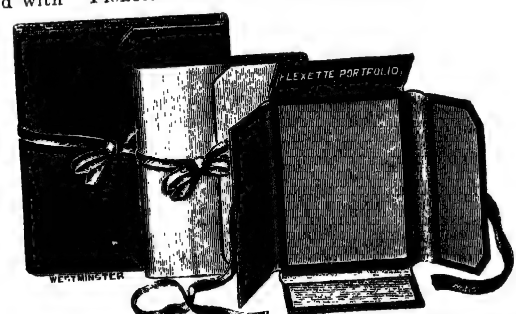


stancy of the light being a further positive advantage in the latter work. The price, complete with 6-ft. flexible wire, plug, burner, two resistances, and tray, is £1 10s.

"FLEXETTE" PRINT PORTFOLIOS.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

These portfolios for the storage of prints are very strongly made with a covering of art canvas of various unobtrusive shades, and are lined with "Flexette" mounting paper of suitable tint. They

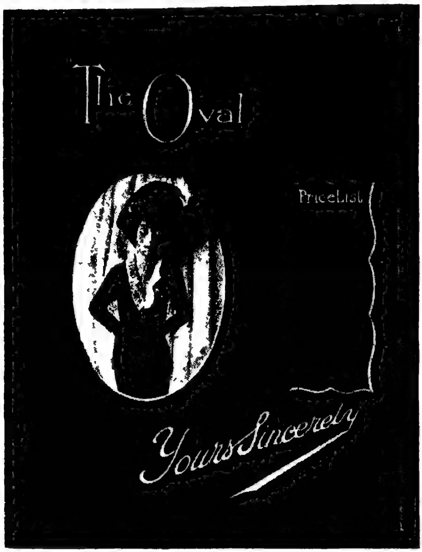


are extremely artistic in appearance, and of substance which will last for years without becoming shabby. They form a convenient means of storing prints in a way in which they can be readily shown to friends. In 8 x 6 inch size the price is 2s.; 10 x 8, 2s. 6d.; and 12 x 10, 3s. 6d.

PHOTOGRAPHERS' SHOWCARDS.

(Made by the Tress Company, 4, Rathbone Place, Oxford Street, London, W.)

A very novel series of showcards for use in the entrance or show window of a photographer's premises has been designed by the Tress Company. It consists of a 12 x 10 frame, containing blank space for the photographer's own particulars for notice. The feature of the board is the figure, which is made in relief with a fashionable hat and a draped background of real material. We can understand that many photographers who are sticklers for



dignity would dislike any advertisement of this form, but in many studios of the bread-and-butter order there is no doubt that they provide a means of attracting customers such as no printed or coloured announcement would do. Three separate styles are obtainable, price 3s. 6d. each, or 9s. the set.

THE SPENCER "PORT-LAND" SOFT FOCUS LENS.

(Sold by James A. Sinclair & Co., Ltd., 51, Haymarket, London, S.W.)

A quite special form of lens has been introduced under this name for the production of negatives with a certain pleasing degree of diffusion when the full aperture of the lens is used. At small aperture, $f/16$ and less, the results more nearly approximate to

those of a lens of the ordinary type, but using the full $f/4{\cdot}5$ or $f/5{\cdot}6$ the definition is of a kind which without being in any way positively fuzzy is not of the biting sharpness of a modern anastigmat. The result is that the apparent depth of focus is surprisingly great, the definition extending to both near and distant objects. For portraiture, figure studies, and general outdoor work, the lens is certainly one which will recommend itself to those capable of appreciating the pleasing way in which it renders masses and particularly of subjects in strong sunshine. It is made in five sizes, the 6-inch, for a 5 x 4 plate, price £4 10s., and the 9-inch, covering a whole-plate, price £5 10s.

THE INDISPENSABLE SELF-PRINT-TRIMMING BOARD.

(Made by Wahltuch, Smith, and Co., 30, Chapel Street, Salford, Manchester.)

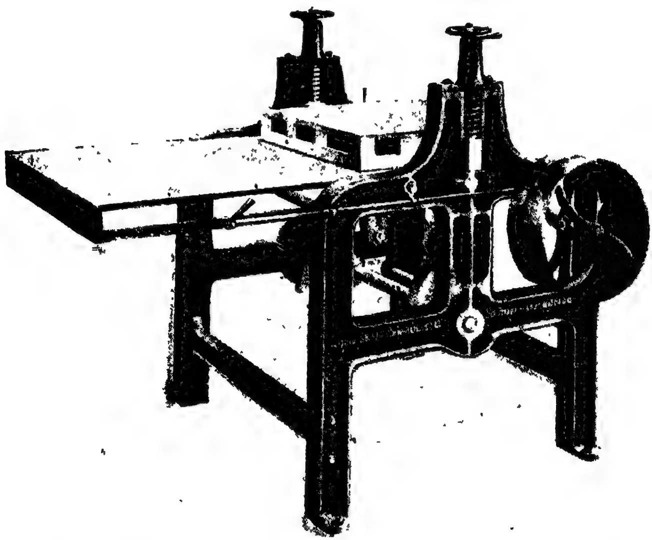
This is a very useful appliance for the professional photographer since it serves to hold the oval mask or template firmly on the print

when trimming ovals or circles by the usual method of running a wheel trimmer round the cutting shape. The board is of stout zinc, mounted on a wood base, and measures $10\frac{1}{2}$ x 9 inches. The price is 5s. 6d.

ADHERENT POWER DRY-MOUNTING MACHINE.

(Made by Adherent Tissue Co., Ltd., Northumberland Place, Fore Street, Upper Edmonton, London, N.)

In this machine for the largest and most extensive work of dry-mounting the bed is moved to and fro and the hot pressure applied by power, which may be that from any existing shafting or the machine can be supplied with a suitable electric motor. The gear which provides the two movements is of a very simple kind. The platen pressure block, heated by gas, measures 30 by 22 inches, with a clearance of 40 inches between its two supporting brackets. Thus, the largest mounts may be used. The bed of the machine is

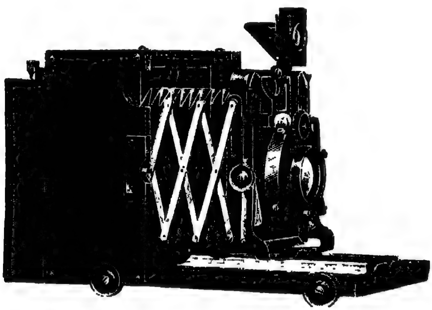


over twice the size of the hot pressure block, and by its travel to and fro allows of the machine being used by two operators standing one at each end of the bed. Whilst the hot pressure is being applied to one print, a fresh mount and print are being placed in position on the bed, so that the working of the machine is continuous rapid, it being claimed that 350 prints of 30 by 22 inches size can be mounted on 30 by 40 mounts in an hour. There is hand adjustment for longer pressure when necessary, and the strength of the automatic pressure can likewise be set to the desired degree. The price of the complete machine, inclusive of two mounting covers, fixing irons and spirit lamp, is £95, delivered and fixed in London.

THE FOCAL-PLANE "TRELLIS" CAMERA.

(Made by Newman and Guardia, Ltd., 17-18, Rathbone Place, Oxford Street, London, W.)

The "Trellis" pattern of hand-stand camera, which we reviewed a couple of years ago in the "Almanac," has now been issued in a model fitted with the "N. and G." focal-plane shutter, which latter is mounted in a rotating back of the pattern of that embodied in the "N. and G." reflex. The shutter is fitted with adjustment tor time and bulb exposures, quickly obtained in alternation with the instantaneous speeds, and has all the facility of increase and reduction in the speed whilst the shutter remains set. For the rest the camera has the extreme range of movements of the model first introduced, namely, triple extension as well as separate rack for focussing at the wide-angle position, the top of the camera body rising and the baseboard falling for the avoidance



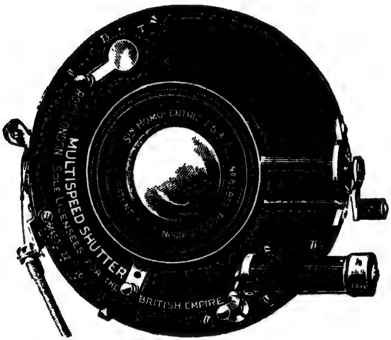
of cut-off and to permit of the front being raised when a wide-angle picture is being taken. There is ample rise of front and of swing front, and the camera is fitted with the familiar "N. and G." folding finder, the lens in which can be raised and thus can indicate the alteration in the subject on the plate when the rising front of the camera is used. The lens is mounted in a "Compound" shutter, which can be used in place of the focal-plane as circumstances require. The whole instrument, in the quarter-plate size, closes quite free from projections to a bulk which is less than $6\frac{1}{4}$ x $6\frac{3}{4}$ x $4\frac{3}{4}$ inches. The lens advised by the makers is Zeiss "Double Protar" or Ross "Convertible," but any other lens can be fitted The price of the camera without lens is £15 10s.

MULTI-SPEED SHUTTER, NEW MODELS.

(Sold by Ross, Ltd., Optical Works, Clapham Common, London, S.W.)

In a previous "Almanac" we described this fine diaphragm shutter and commented upon the convenience to the photographer of securing both low speeds and the most rapid exposures (more

rapid than the focal-plane) in one instrument. In the latest models of the "Multi-Speed" several improvements have been made which greatly facilitate the use of the shutter. First as regards the high speeds from 1-200 to 1-2000 of a second. These are secured by winding, to a greater or less number of turns, the handle seen to the right of the drawing. In the case of the small size of shutter, taking lens-cells up to 1¼-in. diameter, the winding key is made so that it is simply pushed in about ⅛-in. when giving the spring the required tension. In the case of the larger shutter, for lens-cells up to 1¾-in. diameter, the winding key is held in place by a sliding catch, which is released when it is necessary to let down the tension of the spring. A further improvement is that with the modified construction there is now no doubt as to setting the shutter for any given speed. The operations are two in number, and each quite definite, viz., (1) winding the

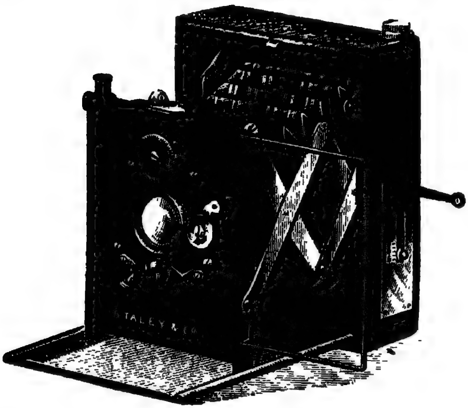


key for from a half turn to 2½ turns of the handle, and (2) pushing the swinging arm, seen below the lens-opening in the drawing, from left to right. The slower speeds, from ½ to 1-100 second, are obtained by winding the handle half a turn and setting the disc on the pneumatic brake to the speed required. In the case of both fast and slow exposures, a given time is repeated as often as desired simply by pushing the swinging arm from left to right, this being all the setting necessary. The operation uncovers the lens—the "Multi-Speed" is not a self-capping shutter—and, therefore, when roll film or a changing box is being used it is necessary to cap the lens when re-setting it. A further minor improvement consists in the setting marks for "time," "bulb," and "instantaneous": these are now widely spaced from each other so that it is impossible to make a mistake when quickly altering this setting. The new models are of the same mechanical excellence as the previous one. They are sold at £5 5s. for the small size, £5 15s. for the medium size, in each case including "Antinous" release.

THE "SONNET" VEST POCKET CAMERA.

(Sold by Staley and Co., 24, Thavies Inn, Holborn Circus, London, E.C.)

An excellent model of the high-class vest-pocket camera is placed on the market under this name. The back body of the camera is of polished mahogany, whilst the base-board is of stout light metal, which provides a very firm support for the lens front. Focussing is provided by a milled head on the back of the camera. The shutter is the well-known "Compound," and the lens the equally popular $f/4{\cdot}5$ Zeiss "Tessar." The adjustments for time, bulb, and instantaneous exposures are conveniently placed, and the shutter is provided with a release stud which is most easily operated, but is not liable to be accidentally depressed when handling the camera. A good feature of the instrument is its freedom from projections



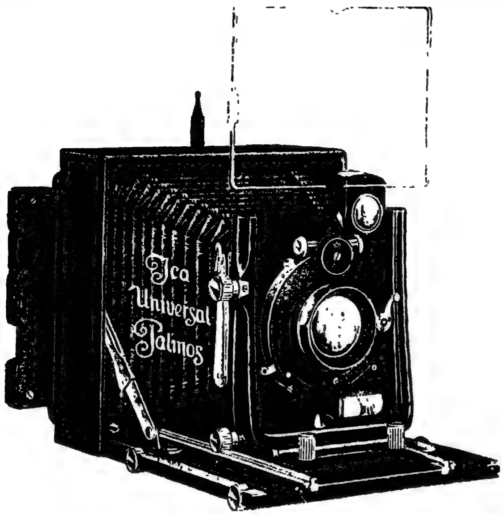
when closed. It is supplied with single metal slides or with film pack adapter and altogether is a most admirable model of the modern high-class camera, taking pictures 6 x 4½ c.m. The price is £10 10s., with $f/4{\cdot}5$ "Tessar" or Euryplan lens and six metal slides.

A NEW UNIVERSAL "PALMOS" HAND CAMERA.

(Sold by Carl Zeiss, 13-14, Great Castle Street, London, W.)

This new camera of the "Palmos" series is constructed entirely of light metal, with the exception only of the detachable frame of the focussing screen. It is of quarter-plate (and 9 x 12 cm.) size, and of triple long extension, 16½ inches from lens to plate. In securing this long extension the excellent plan is followed of causing the camera back to rack to the rear, whilst the lens front is racked forward, with the result that, at the full extension, the camera is supported on the tripod head about midway of its length, thus tending to greater stability. It is, in fact, extremely rigid when fully extended. There is rack and pinion rise of front to

the amount of nearly 2 inches, in addition to about ¼-inch fall. A light and very smooth moving rotating back is fitted. There are two finders, a full-size viewing frame, with sight rod on the camera back, and a brilliant finder, with level, on the lens front. The instrument is supplied with the Zeiss "Double Protar" *f*/7, giving the focal lengths of 11½, 8¾, and 5¾ inches. Other lenses can be fitted, and the camera can be used even for quite wide-angle work. The shutter is the "Compound." Closed the camera measures less



than 6½ x 6¼ x 2½ inches, whilst its weight is 3½ lbs. The price, complete with the "Double Protar" and three double dark-slides, is £24 9s

INK-PROVING COLOUR BLOCKS.

(Made by Wratten and Wainwright, Kodak House, Kingsway, London, W.C.)

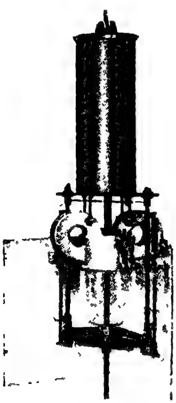
Messrs. Wratten and Wainwright have added another to the many practical devices which have originated with them for facilitating the work of the maker of colour blocks. It consists of a set of three blocks designed to show precisely the effect of the three-colour inks in use. Solid patches are provided in such a way that when taking a proof in register from each of the three blocks the engraver obtains a solid patch of yellow, red, and blue ink, as also the complementaries of these. There is also included in the blocks a half-tone of a graded strip, similar in each block, except that the screen angles run at 30 deg. to each other. Thus no moiré pattern is produced, and the strip receives ink from each colour, yielding a neutral grey if the inks are correct in shade and amount. If the

half-tone scale departs from this grey, it is easy to see in what direction the inks are faulty. This useful set of blocks is supplied as nickeloid electros, mounted on metal exactly to type height. Price 12s. 6d. per set of three.

THE WESTMINSTER No. 119 THREE-COLOUR ARC LAMP.

(Made by the Westminster Engineering Co., Ltd., Willesden Junction, London, N.W.)

This is an adaptation of the Westminster enclosed arc specially made for three-colour photo-engraving work, where intense illumination over a considerable area is a desideratum. The lamp is fitted with a clearing device above the glass enclosure, serving to carry away the fumes from the chemical carbons and keep the glass clear. A hinged mounting of the lower carbon holder facilitates fitting a fresh carbon. As the result of tests made with the lamp in comparison with one of the open-arc type, it has been found that the area of even illumination is about twice as great and the actinic power of the lamp about the same for the red sensation negative, about 30 per cent. greater for the green-sensation, and about twice as great for the blue negative. Moreover, the lamp quickly settles down to its normal burning condition after switching on. On a voltage of from 200 to 240 the lamps burn in series with about 80 volts across the arc, or in single parallel on 100 to 120-volt circuit.



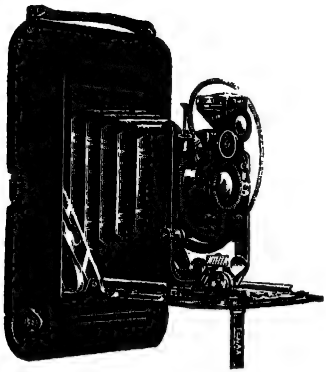
The lamp is made with the regard for simple working parts and reliable construction which characterises the manufactures of the Westminster Company.

TENAX AND TARO-TENAX POCKET CAMERAS

(Made by C. P. Goerz Optical Works, Ltd., 1-6, Holborn Circus, London, E.C.)

The roll film "Tenax" is made in two sizes, quarter-plate and postcard, and in each of these in two models, one with a flush back for the use of workers employing roll film only and the other with a combined back allowing of the use of both films and plates or of film-pack. Apart from this difference the two models are similar, and on the general lines of the well-known "Tenax" cameras for plates. They are of all-metal construction and substantial, though by no means heavy. The lens-front is of highly solid and rigid U-pattern, affording ample rise of lens, and itself sliding to and fro so as to give rise or fall of lens the landscape way of the plate. It carries the "Compound" shutter, and, as lens, either the Goerz "Dagor," "Celor," or "Tenastigmat." The finder is of the brilliant pattern, of extra large size, and fitted with level. Focussing is done by a very strong rack and pinion

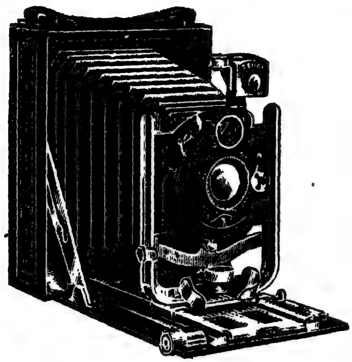
movement, and, in the case of the cameras for plates, an auxiliary focussing scale is provided. Stout supporting legs, for use when giving time exposures without a tripod, are provided for both the upright and horizontal positions. The arrangements for the film are very conveniently contrived as regards ready removal of the exposed spool. In the quarter-plate size the camera has an



extension of six inches, but is obtainable of double extension at the extra price of 10s. With Goerz "Dagor" lens the price is £10 5s., with the "Celor" £10 15s., or with the "Tenastigmat" £7 10s. The extra cost of the model with the combined back for plates and film is 5s. The camera is one which is thoroughly well made throughout every detail, and may be recommended to withstand the hardest wear and the tests of climatic conditions in any part of the world.

In the additions to the Goerz "Taro-Tenax" series of cameras the makers provide an exceedingly high-class instrument at a popular price. In the quarter-plate size, with Goerz "Tenastigmat" lens and "Compound" shutter, the price is £6 5s. The camera is of metal throughout, and though light is extremely rigid, both at the normal extension and with the lens drawn to its full distance at 10 inches from the plate. The U-form front is provided with lever-movement rise of half an inch and with sliding cross movement. The finder is of the brilliant reversible pattern with level attached, whilst the shutter is the reliable and efficient "Compound," speeded from 1 to 1-250 sec. and fitted with "Antinous" release. To those who desire a highly portable camera of the beautiful workmanship and design characteristic of the Goerz factory, the "Taro-Tenax" will make a strong appeal. Complete with three dark-slides and with *f*/6·8 "Tenastigmat" lens, its price, as we have said, is £6 5s., or £5 15s. with "Ibso" shutter. It can be supplied with the Goerz *f*/6·8 "Dagor" double anastigmat, price £9, with "Compound" shutter.

In postcard size the price of the "Taro-Tenax," fitted with the Goerz "Tenastigmat" of 6⅝-ins. focus, mounted in "Ibso"

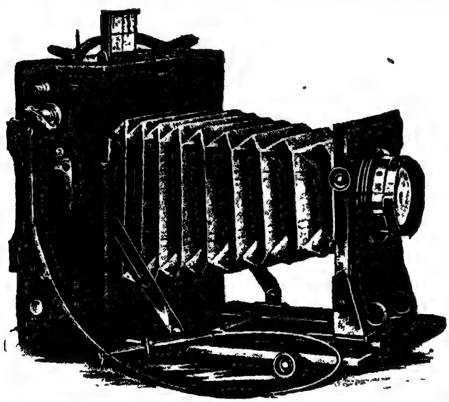


shutter, is £7 11s. 6d., including three single slides: with the "Compound" shutter the price is £8 6s. 6d.

THE "SPEED GRAPHIC" FOCAL-PLANE HAND CAMERA

(Made by Kodak, Ltd., Kingsway, London. W.C.)

This camera, made in 5 x 4, postcard, and 7 x 5 sizes, is fitted with the well-known "Graflex" multiple-slit focal-plane shutter,



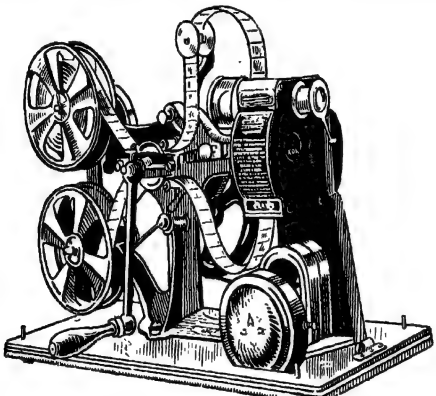
with its most reliable mechanism and convenience of giving a series of exposures of increasing time without re-winding. The lens front is of large size to take modern $f/4{\cdot}5$ lenses, and of great rigidity. It has good rise, 1¼ inch in the 5 x 4 size. The exten-

sion, in this size, is 10¾ inches. Direct-vision view-finder is fitted, as also hooded focussing screen, which is made a fixture at the back of the camera, being attached thereto by springs, and allowing of the plate-holder being simply thrust in and held in position by the focussing screen itself. Without lens the price of the camera, with one double plate holder, is £7 10s. in the 5 x 4 size; postcard, £8; 7 x 5, £9 5s. The camera is of the highest class of workmanship.

THE PATHESCOPE HOME CINEMATOGRAPH.

(Sold by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

A cinematograph projector, which is absolutely self-contained—producing the living pictures and the light for their projection by the turning of a handle—is the latest and most attractive develop



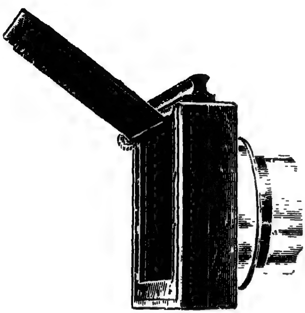
ment of cinematography. The instrument is about the size and weight of an ordinary hand sewing machine. It gives an exceedingly well-illuminated picture, about 3 ft. by 2 ft. The film is of a somewhat narrower width than that in standard machines, but the results upon the screen are of the smoothness and freedom from flicker which are characteristic of the standard productions of Messrs. Pathé. Films for the machine may be selected for purchase from Messrs. Pathé's large stock, price 2d. per foot. The light in the Pathéscope is a small over-run metallic filament lamp, operated by a magneto which is rotated by the handle which moves the film. The light, therefore, in the ordinary way, is produced only when the machine is working, but Messrs. Houghton have added a useful accessory in the shape of a battery which is employed to supply the light when the machine is stationary; it thus allows of any given picture in the series being examined as

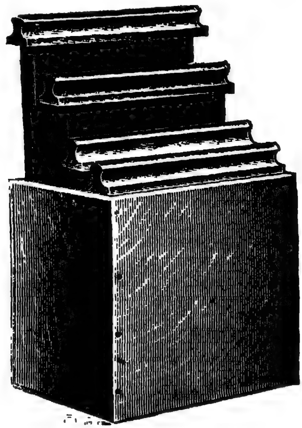
though it were an ordinary lantern-slide. The price of the complete outfit, including the Pathéscope machine, spool of film of two subjects, screen, case, and cleaning outfit, is £15. Extra for battery attachment, 35s.

A NEW WRATTEN FILTER HOLDER.

(Sold by Wratten and Wainwright, Ltd., Kodak House, Kingsway, London, W.C.)

This is a new model of fitting serving to hold light-filters when in use on the lens. As shown in the drawing, it consists of a frame into which the filter (mounted in a handle) is inserted. It also carries a light-tight flap by which exposure is made. The filters





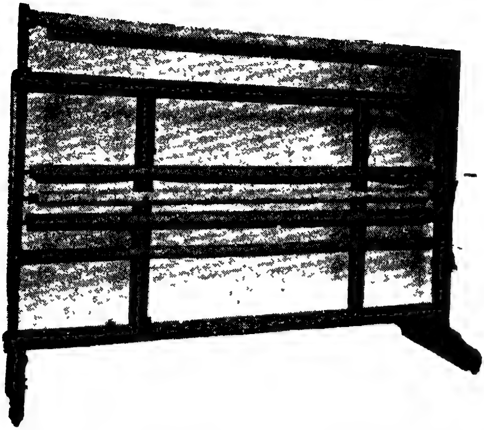
themselves are sent out in a case provided with grooves so that they are always in a place of safety—either in the holder or the grooved case. Particularly for the use of the technical photographer, or photo-engraver, employing the best form of filter—namely, those in Hilger flats—this holder is a most suitable one. Its price is from 35s., according to size, exclusive, of course, of the filters themselves.

THE SICHEL BACKGROUND FRAME

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

In this new pattern of background holder for the photographic studio a wooden frame is used both for holding the rolled-up grounds not in use and for supporting the one which is extended. The frame is operated entirely from the front, the handle A raising the upper frame which supports the background, whilst B lowers and raises again the ground itself. From the fact that the photographer has not to work from the rear of the frame, all

his manipulations of the backgrounds can readily be done by himself alone. The raising and lowering gear is most substantially

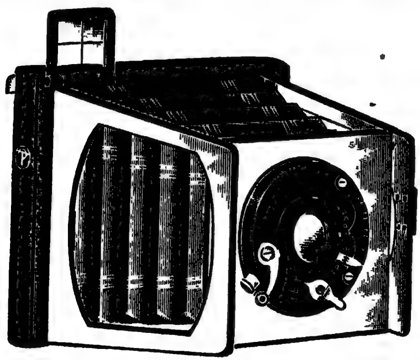


made, bicycle chain being used for connecting the pulleys. Price, with one roller, £5 5s.; extra rollers, 6s. each.

THORNTON-PICKARD POCKET HAND-CAMERAS.

(Made by the Thornton-Pickard Manufacturing Co., Ltd., Altrincham.)

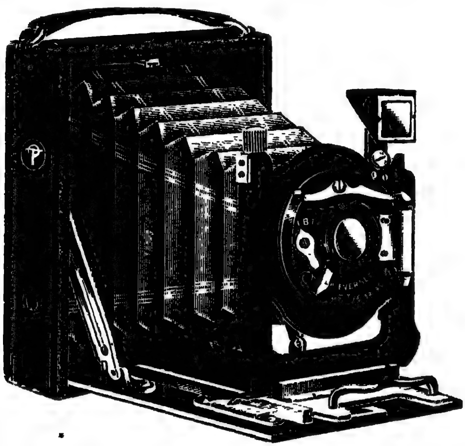
A quite new model of plate camera is the "Klippa," a folding camera for 3¼ x 2¼ plates. The front and side wings are of



polished aluminium, the grooves in the wings providing a considerable rise and fall of front. The direct-vision finder is ingeniously fitted to form a bolt fixing the wings within the space of

the back body when the camera is folded. On simple pressure upon a stud the finder flies up into position, the wings likewise extend themselves, and one has only to pull out the lens-front and snap it into the grooves to have the instrument ready for use. With single lens, diaphragm shutter with time, bulb and one speed, the price, inclusive of two single metal slides, is £2 2s., or with R.R. lens, £2 10s. The very slim dimension of the camera when folded admirably fits it as an instrument for the pocket.

In new cameras of the very portable and inexpensive type the Thornton-Pickard Company have an extensive series in the "Imperial Pocket." The drawing shows the No. 1 made in quarter-plate size only, price £1 15s. with single lens, everset shutter, and time exposure valve. The series is characterised by extreme rigidity



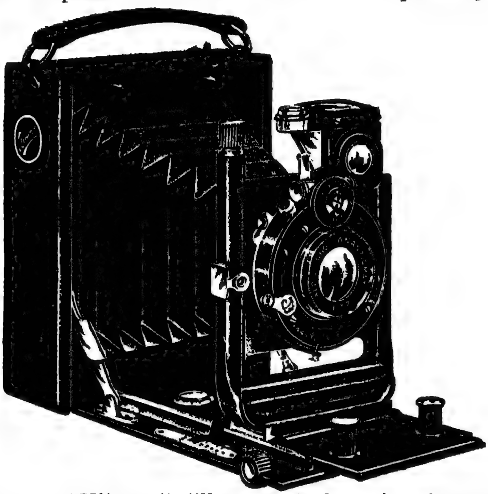
and solidity of construction, though the use of aluminium and other light metals prevents the instrument from being heavy. The fittings, as regards finders, focussing scales, rise of front, etc., are most convenient, and the amateur worker cannot surely expect a greater number of facilities provided in well-made cameras issued at such extremely moderate prices. The "Imperial Pockets" are made also with rack focussing and of double extension pattern, the No. 7, which is the last of the series, being sold at £3 12s. 6d. with R.R. lens in "T.P." automatic shutter. It is supplied also as Nos. 8 and 9 with "T.P." sector shutter, or with the "Compound" or "Koilos."

"KLIMAX" AND "UNO CAMEO" HAND CAMERAS.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E C.)

In the 1914 models of the "Klimax" cameras the characteristic features of extremely solid yet light construction entirely of metal

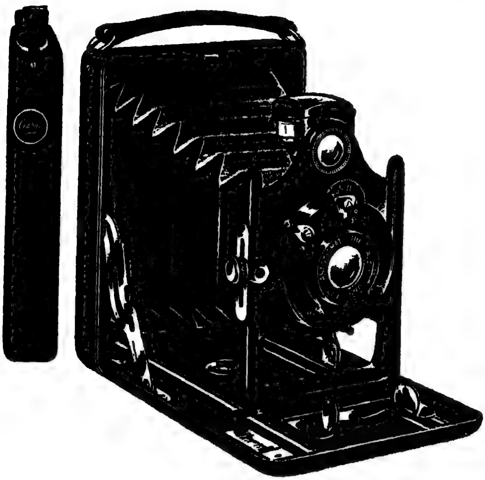
is maintained throughout a wide range of instruments. The cameras are made of both double (models II. and III.) and single extension pattern, and though issued at moderate prices have a very wide range of movements. In addition to screw rise of front, there is cross front movement of the very massive U-form support of the lens front and, what is rarely fitted in cameras of this class, a swing of the camera back to a limit each way. A further very good feature is that the entire shutter with the lens in it can be removed in an instant from the camera front. The dark-slide, too, is of a new pattern fitted with spring clips for quickly allowing of the insertion of the plate and firmly holding it in position. Each slide is provided with a white panel on the back, on which particulars of exposure can be written. In the quarter-plate size



of the model I. "Klimax" (illustrated) the price, including two metal single slides, is £4; with Aldis "Uno" $f/7{\cdot}7$ anastigmat, in 5 x 4 and postcard, £4 15s.; and in half-plate, £5 15s. In models II. and III. the general design is the same, but the cameras are of double extension. The prices corresponding with those just given are £4 12s. 6d., £5 7s. 6d., and £6 7s. 6d., whilst in model III. (made only in the quarter-plate, or 9 x 12 cm. size) an extra large body and heavy front are provided for the use of $f/4{\cdot}5$ anastigmats. The shutter in this case is the No. 2 "Compound." The price, with Aldis $f/4{\cdot}5$ anastigmat is £9 17s. 6d.

In the "Uno Cameo" camera of $3\frac{1}{2}$ x $2\frac{1}{2}$ inch size either plates or film pack may be used. The camera measures less than 5 x $3\frac{1}{2}$ x $1\frac{1}{2}$ inches when closed. Like the "Klimax" series it is of very rigid build, and has lever movement for the rise of lens and ample rise the landscape way of the plate. As with the "Klimax," also the fittings in the matter of shutter, finder, and level are

excellent. With two single metal slides and Aldis "Uno" $f/7{\cdot}7$ anastigmat in "Lukos II." shutter, the price is £2 5s. The camera is also supplied in quarter-plate size at £2 15s. For an



extra 7s. 6d. on these prices the cameras are supplied with dust protectors for the dark-slides, film-pack adapter and leather case with shoulder strap.

PASTE-IN ALBUMS WITH JAPANESE COVERS.

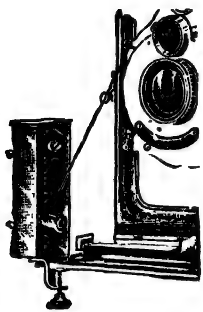
(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

These are a quite new style of albums offered particularly to the professional photographer for the purpose of exhibiting the specimens of his work advantageously to customers. The leaves of the album are of stout brown paper, interleaved with film tissues of very pleasing pattern. The covers are of special genuine Japanese canvas of most artistic design and colouring, and obtainable in over fifty different patterns. The leaves are simply laced into the covers, so that by untying the silk cord which holds them any re-arrangement of the portraits in the album may be made. Photographers are often criticised for the way in which their work is offered for the inspection of customers in the reception-room. The use of such albums as these should be sufficient to suggest to the customer that the photographer is a man who delights in beautiful things. Moreover, the setting which the portraits thus obtain is bound to be to their advantage. The albums are supplied in two sizes, large, measuring 14 x 10 inches, price 5s. 6d. each; and small, 12½ x 9½ inches, price 4s 6d. each.

"EFFWEE" SELF-EXPOSURE ATTACHMENT.

(Sold by John J. Griffin and Sons, Ltd., Kingsway, London, W.C.)

This is a useful little accessory for purposes of self-portraiture, or for many other occasions when it may be necessary to start the exposure while one is at a distance from the camera. It is a small clockwork device, measuring about 3 x 1 inches. A few turns of a key winds it. Pressure on a release then causes the clockwork mechanism to start a lever moving, the lever reaching the end of its travel in about 15 seconds. Thus, in the case of a photographer wishing to include himself in a group, there is ample time for him to do so after having started the attachment, but the



release itself may be readily actuated by a light cord operated from a distance. The "Effwee" is sold in three patterns, according to type of shutter to be used with it, the prices being 3s. 9d., 4s., and 5s.

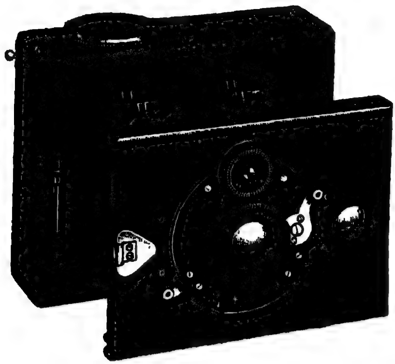
"CONTESSA" FOLDING POCKET CAMERAS.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

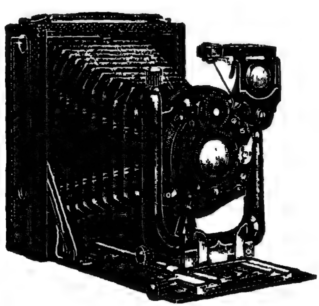
Since their first introduction upon the British market, the "Contessa" cameras have undergone very complete revision at the hands of the makers. They now represent an altogether excellent series of light-model folding cameras fitted with high-class lenses and providing the adjustments necessary for a very wide range of photographic work. We may take, as examples, the "Duchessa," a vest-pocket instrument for either plates or film pack of 4½ x 6 cm. It is an extremely neat little instrument, measuring when closed less than 3¾ x 3 x 1 inch, and provided with focussing scale by means of a milled disc on the back body rather larger than a shilling, and thus facilitating the focussing adjustment. A good point about the focussing movement is that it allows of lenses of from 2½ to 3¼ inches focal length being used and also of the camera being closed with the focussing scale set to any

required distance. The camera includes a folding brilliant finder, which closes within it when the camera is shut, "Compound" shutter and bush for use on a tripod. With $f/6{\cdot}3$ anastigmat the price is £5 12s.; £8 17s. with the Zeiss $f/4{\cdot}5$ "Tessar."

The No. 835 "Contessa" is fairly representative of the construction and design of the larger "Contessa" cameras. It is of



quarter-plate size, with extension of 8½ inches; solid U-form front with screw rise, folding reversible finder and level and stout bushes for attachment to tripod. The body of the camera is of nicely



rounded shape, the ground glass being mounted in a metal frame, to which is secured the leather focussing hood. Light, but strong, the cameras should be popular with users of this class of instrument. With $f/7{\cdot}7$ anastigmat, the price with "Derval" shutter is £3 9s.; £3 19s. with "Ibso" shutter; and £4 11s. with the "Compound."

A TOURIST'S METAL TRIPOD.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

A specialty of the Westminster Exchange is this light aluminium six-fold tripod, extending to the full length of 4 ft. and closing to 11 ins. The top section is covered in best calf leather, which covering, in conjunction with a couple of leather caps connected by a strap, dispenses with the need of a separate case, while it makes the tripod an exceedingly convenient one in use. Another notable feature

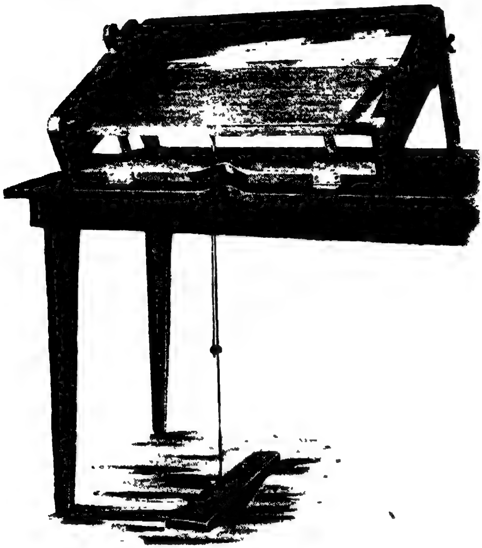
is that the joints of the tripod legs are lined with brass in all cases and thus safeguard the tripod from the jamming or sticking which is liable to occur with an aluminium tripod. The tripod is remarkably steady when erected and a very useful piece of apparatus for work with a small hand camera. The price is £2 2s.

THE EASTMAN FOOT-POWER TRIMMING BOARD.

(Made by Kodak, Ltd., Kingsway, London, W.C.)

An extra large size of the trimming board of this pattern, described in a previous "Almanac," has now been introduced provided with foot treadle for actuating the board on which the print rests during trimming. This No. 4 model has a 20-inch

blade, and, like the smaller sizes, is fitted with a celluloid sheath under which the print passes and by which it can be most exactly adjusted for the production of white margins in the case of prints



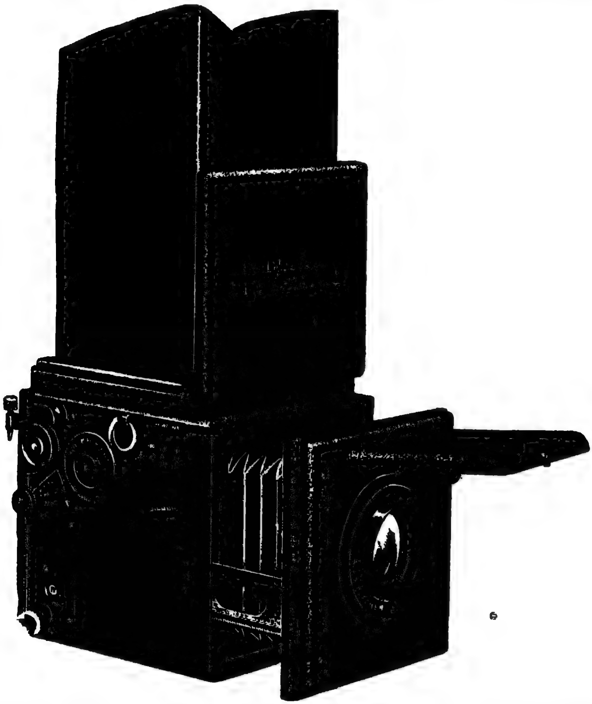
from masked negatives. The trimmer is an excellent pattern for professional or commercial photography. The price is £1 15s.

THE "POPULAR PRESSMAN" REFLEX CAMERA.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London.)

An altogether new model of reflex camera is being issued by Messrs. Butcher under this name. It is of quarter-plate size, and, at the price of £9 15s., complete with $f/4 \cdot 5$ anastigmat, is offered at a remarkably low figure. Yet in it the makers have provided reflex users, and particularly those employing this type of camera for Press work, with excellent facilities. Prominent among these are the readiness with which time exposures may be given and the equal ease with which the camera may be used at the eye level as an ordinary focal plane after having focussed by means of the mirror. These are important points to the Press worker, for in the case of many rapidly moving objects it is good practice to work, without the mirror, by the shutter alone, whilst there are, of course, many occasions when time exposures require to be given, placing the camera upon a firm support. The shutter and its adjustments are of

distinctive design. The blind is of the three-slit pattern, having openings measuring 3, 25, and 100 mm., the latter the full length of the plate. As shown in the drawing, the shutter is set on the fan-shaped dial, differently according to the user's requirements. Setting the pointer in the middle opposite the word "open," the shutter, on release, cannot run down beyond the particular slit for which it is set; on repeated re-winding it continues to give these exposures. But, if set to the upper, or lower, edge of the dial (according as



higher or lower speeds are required), the shutter will give a series of exposures with all the slits in the blind without re-winding. In general work it will probably be convenient to work at the mid position, but occasions crop up when a longer exposure without re-winding is convenient. The wind is quick, a half-turn sufficing. The release, when using the mirror in the ordinary reflex way, is by a trigger towards the front of the camera, but when using the instrument as an ordinary focal plane the mirror is locked in the up position by turning the milled head, and exposures then made by moving the stud near to the setting dial. Alteration of speed, apart

from width of slit, is secured by one or other of two spring tensions, R (rapid) and ER (extra rapid). The full range as given on the convenient speed table is from 1-15th to 1-1,000th of a second. The camera is of the single-extension pattern, affording a distance from plate to lens of 9 ins. It has sliding lens-panel giving nearly ½ inch rise and the same amount of fall. The lens is securely covered by a light leather-covered metal frame which springs up, forming a screen. Dark slides, or film-pack adapter, are carried on the detachable back, which is quickly unshipped from the camera body and placed either upright or landscape way. The focussing hood, of self-erecting pattern and square shape, is 8 ins. deep. It instantly springs into position on removal of the cover, whilst its size allows of the ground glass being easily cleaned. The focussing screen, to mention one minor point, is placed ground side up, an aid to focussing owing to the reduction of reflections. In all these respects the camera has evidently been designed for quick and efficient use in practice; its light build and small size for a reflex—it comes within 6½ x 7 x 5½ ins.—admirably qualify it for all descriptions of work. Its very low price of £9 15s. includes, as we have said, the Aldis-Butcher *f*/4·5 anastigmat of 6 ins. focal length, and six single metal slides of excellent pattern, each provided with matt celluloid panel, on which may be written particulars of the exposure.

THE "SPECIALIST" STEEL WRITING POINT.

(Sold by Ernest Bickersteth Fry, Ltd., 110, Pratt Street, Great College Street London, N.W.)

This is a handy steel stylus, sold for the purpose of writing titles, diagrams, etc., on the opaque notice plates used for this purpose by lanternists and cinematograph exhibitors. The stylus is supplied

COVER FOR POINT.

with a cover for the point, and sells at the price of twopence. As regards the opaque-coated plates for which it is used, it should be noted that Messrs. Fry now supply these in a new form—namely, with a white coating over the black. Owing to the greater reflecting power of the upper surface, the glass heats more gradually in the lantern, and thus avoids sudden fracture of the plate, which is liable to happen as the result of the black coating absorbing heat quickly. The double-coated plates still give a line which is perfectly clean cut and free from raggedness, and the plates can be rubbed without disturbing the deposit. The white surface also allows of a sketch being first made in pencil and then cut through with the stylus. The price is 1s. per box of twelve, 3¼ x 3¼ inches size.

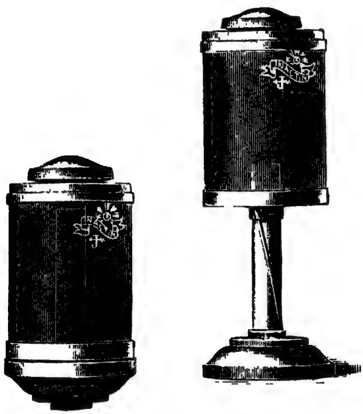
For use with such announcement slides in clear lines on an opaque ground, Messrs. Fry issue a "Rainbow Slide," a 3¼ x 3¼ glass, in

which colours are gradated from blue to red in the manner of a rainbow. The announcement is thus shown on the screen in colours which are different in different parts. The enhanced effect is most cheaply obtained, for the cost of the rainbow slide is only 6d.

THE "WESTMINSTER" CANDLE TRAVELLING LAMP.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

A very handy form of dark-room lamp for the photographic tourist is supplied under this name. It carries a candle, which is contained in a metal tube, in which it is kept pushed up by a coil of spring so that the last bit of a 4-inch candle may be consumed. The lamp proper consists of a cylinder of safe pot ruby glass of 3 inches dia-



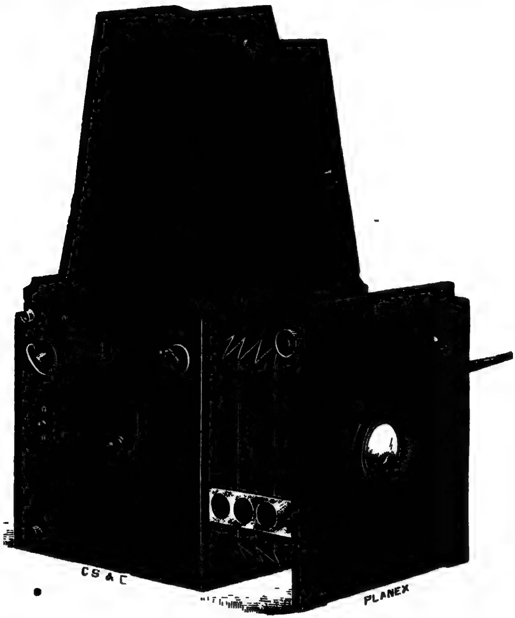
meter, provided at top and bottom with light-trapped apertures which supply efficient ventilation. In use the lamp stands about 10½ inches high; packed for travelling it measures 5½ inches long by 3½ inches diameter. A most useful and cleanly pattern of travelling lamp. Price 3s. 6d.; extra ruby cylinders, 1s. each.

THE "PLANEX" PRESS REFLEX CAMERA NO. 2.

(Sold by the City Sale and Exchange, 90-94, Fleet Street, London.)

In this improved model of moderately-priced reflex camera the makers have provided the practical conveniences which reflex users require. In half-plate size, the instrument is, of course, not small—it measures 8½ x 9½ x 10 inches—but then it is built square, with rotating back mounted on metal. Its single extension provides 15 inches from lens to plate, the lens front being of exceptional rigidity, even at the full extension. There is a rise of one inch by rack and pinion, and the lens panel is provided with a deep box which, in conjunction with the lens screen, efficiently

shields the lens. The mirror, mounted so that it falls automatically after each exposure, is provided with a catch for holding it in the up position. The focal-plane shutter, of very quick wind, has rapid adjustment of the slit width, which, in conjunction with the range of spring tension, provides for the widest range of speeds, from 1-6 secs. up to the shortest exposures. There is also convenient and quick adjustment for time exposures. The camera throughout is of light yet strong build. Complete with three excellent double plate-holders of solid pattern the price in the half-plate size, without



lens, is £12 12s.; in quarter-plate size, £8 8s.; and in postcard, or 5 x 4, £10 10s. The camera may be fitted with all the leading makes of anastigmat lenses, the suitable foci being 8¼ in the half-plate size, 7-inch in 5 x 4 or postcard, and 6-inch in quarter-plate.

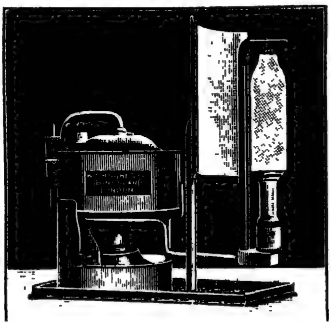
"LUNA" SPIRIT-BURNER LAMPS.

(Made by W. C. Hughes and Co., 82, Mortimer Road, Kingsland Road, London, N.)

Since the first introduction of the "Luna" spirit mantle lamp for enlarging and lantern projection several new models have been issued, among them, during the past few months, the "Double Illumination" Luna and the "Long Tube" Luna. The former

is a lamp of specially large mantle, about 3½ inches in height, and backed by a polished reflector, about 5 inches square, which contributes considerably to the diffusion of the light. The lamp is a very powerful source of artificial light, and suffices for bust or three-quarter length portraits on ultra-rapid plates with a large-aperture lens. Being light and portable and entirely self-contained, a couple or so of the "double-illuminating" Lunas should be of service for at-home portraiture. The price of each, complete with mantle and reflector, is £2 2s.

For use in the many enlarging lanterns of recent type fitted with fairly large bodies a special model of the "Luna" has been introduced, in which the tube joining the spirit reservoir to the burner is about 7 inches in length. This form of lamp allows



of the spirit reservoir being placed outside the lantern with advantage to its lower temperature and ease of giving the lamp the (very slight) attention which it requires in use

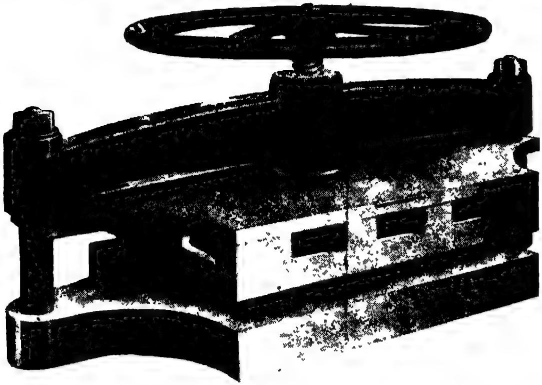
A further light-source, in which the "Luna" reservoir and burner is employed, is a form of alcohol lime-light jet, in which the spirit vapour serves the purpose of the hydrogen whilst the oxygen may be obtained from "Oxylith," used in a small generator, or may be drawn from a cylinder of the compressed gas. By the construction of the jet the oxygen is considerably heated before it gets into the burner, thus adding very greatly to the candle power of the light. The apparatus is one which should solve the problem of many lantern exhibitors called upon to give exhibitions where neither coal gas nor electric current are available.

ADHERENT DRY-MOUNTING PRESS.

(Made by the Adherent Tissue Co., Northumberland Place, Fore Street, Edmonton, London, N.

In the latest pattern of their dry-mounting press the Adherent Tissue Co. provide an exceedingly well-designed and fitted press with heated box 16 ins. wide and 12½ ins. deep, thus serving for

the mounting of a print of 16-inch width and any length. The arms of the press being 24½ ins. apart, large mounts can be inserted. The gas burner is fitted with adjustment for both air and gas supply.

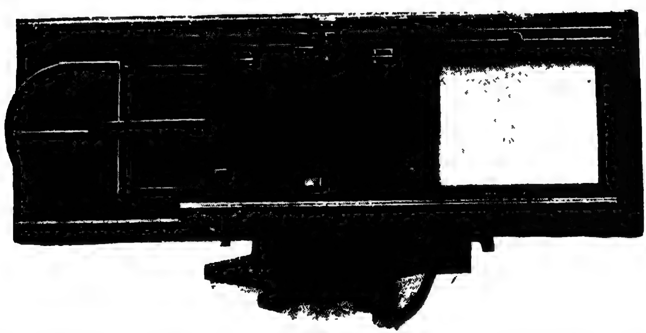


The whole press is well finished in black enamel, with thermometer in brass holder, and is supplied at the moderate price of £4 4s.

THE "EXCELSIOR DE LUXE" STUDIO CAMERA.

(Made by Marion and Co., Ltd., Soho Square, London, W.).

The new model of this studio camera possesses special features of importance to the studio operator. These lie chiefly in the camera



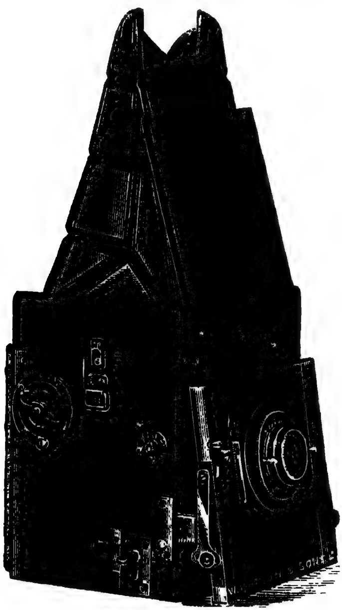
back, which, as shown in the drawing, carries the focussing screen and dark-slide. It is fitted with catches so that the act of pushing the ground-glass along brings the dark-slide into position with the shutter drawn ready for exposure This may be done when using

two half-plates in the slide, or when taking one or more pictures on the whole-plate. When the whole-plate is being used, the operator may often wish to take the picture horizontally instead of vertically, or *vice versa*, and this contingency is provided for by the rotation of the back. In other respects, such as vertical and lateral swing of the back—both by rack and pinion smooth focussing movement, etc.—the camera is excellently provided, and is an extremely high type of studio instrument. The price, complete with one slide, is £15 15s. At an extra cost of 15s. it is fitted with a bag-form focussing cloth round the frame of the ground-glass. The cloth is thus in position all the time, whichever way, either vertical or horizontal, the portrait is being taken.

A NEW MODEL "PERSPECT" REFLEX CAMERA.

(Sold by W. Watson and Sons, Ltd., 313, High Holborn, London, W.C.)

In this reflex camera the shutter is the well-known "Unit," the various speeds of which are obtained by alteration in the width of



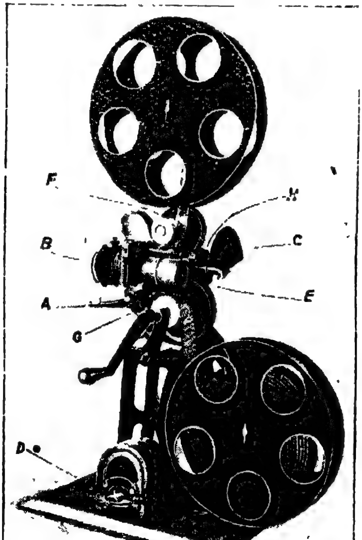
the slit. The shutter has very rapid wind and adjustment to various speeds, as well as to time and is a very convenient instrument for workers, such as Press photographers. The "Perspect"

is likewise fitted with rack-and-pinion rise of front, giving a rise of close on 1½ inches. It also has swing-front movement. The mirror is of the type which falls automatically after exposure, the shutter release being made by pressing down the lever which first raises the mirror. In the quarter-plate size the extension of the camera is 10 inches, and is very rigidly obtained on a pair of stout brass runners; the hood is of 7 inches height, and is instantly turned back on its frame to allow of cleaning of the ground glass, and, by removal of the latter, of the mirror. A rotating back provides for horizontal and vertical pictures. The camera is an excellent example of a simple, but efficient, reflex. Without lens, but including three double dark-slides, its price is £13 5s., quarter-plate; £15 15s., 5 x 4; and £19 10s. half-plate.

THE TRESS HOME CINEMATOGRAPH PROJECTOR.

(Made by the Tress Company, 4, Rathbone Place, London, W.)

A most excellent little instrument for showing living pictures upon a moderate scale, such as 4 ft., is a quite new introduction



by the Tress Company. The projector has the very positive advantage of taking the standard size of film, and hence may be used by those able frequently to pick up films at small cost in

the sale rooms, whilst it also renders available the great mass of illustrated matter current in the film-hiring trade. The projector may be obtained either to draw current from the ordinary house supply or to generate it by a little dynamo which is geared with the handle of the machine, so that the light is generated simply by running through the film. In both cases a small metallic filament lamp is used slightly over-run. The design of the mechanism is good and the construction of the most substantial kind. Finally, the price is one which is less than a good many ordinary optical lanterns—namely, £3 17s. 6d. without dynamo, £5 5s. with dynamo, in each case complete with lamp and screen.

ANSCO 1A AND 3A FOLDING POCKET CAMERAS.

(Made by Ansco, Ltd., 143-149, Great Portland Street, London, W.)

These two new models of the Ansco film cameras are for pictures $2\frac{1}{2}$ by $4\frac{1}{4}$ and $3\frac{1}{4}$ by $5\frac{1}{2}$ ins. respectively. The 1a camera is for film only; the 3a for both plates and film. The 1a is fitted with a

fixed lens front, whilst the 3a has ample rise of front each way of the plate. With these exceptions the cameras are of similar construction. Both are of exceedingly strong, yet light build, are fitted with automatic-locking focussing scale, Ansco automatic shutter, and reversible brilliant finder, the mask in which automatically rotates when the finder is moved from one position to the other,

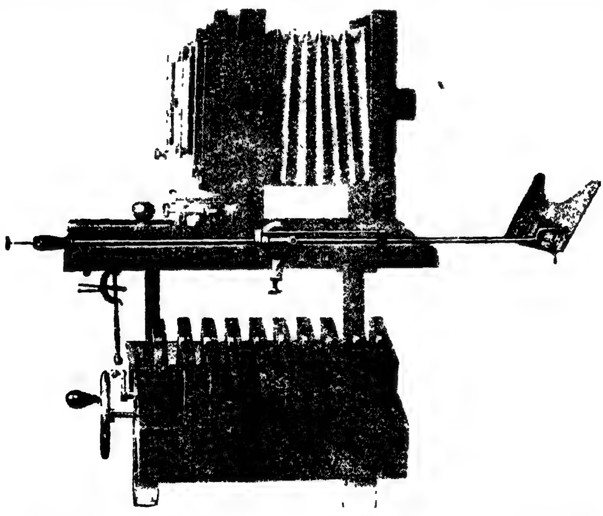
thus showing exactly the shape of the picture which is being taken. Covered in black leather and with nickelled fittings throughout, the cameras are of extremely attractive appearance, and their

looks are not inferior to their excellent design and working qualities. The price of the 1a is £3 18s. and of the 3a £5 10s., in each case with rapid rectilinear lens.

THE "CENTURY" VIGNETTER.

(Sold by Kodak, Ltd., Kingsway, London, W.C.)

In this camera vignetter the fullest range of movements is provided at the rear end of the accessory, the vignetting mask



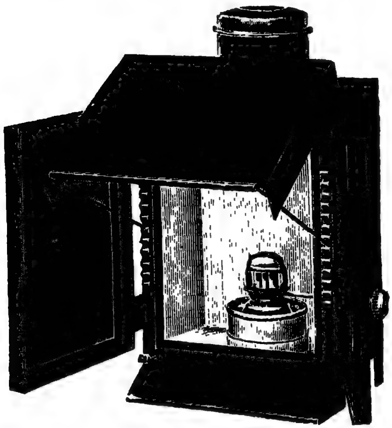
being moved to and fro, raised and lowered, and tilted by the handle and milled head seen to the left of the drawing. Set

screws are provided which hold it firmly in position once it has been adjusted. The appliance is exceedingly well made in bronze metal, and is instantly secured to the camera baseboard by a clamp. The price is £1 12s. 6d.

THE "WESTEX" DARK-ROOM LAMP.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

A very inexpensive, but efficient and well-designed, lamp. It is fitted with two screens, one ruby and one fairly deep yellow, each 4½ x 7 inches. These fold with a deep rebate on the front of the



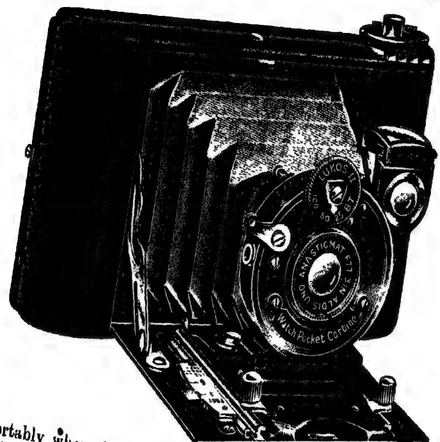
lamp and are perfectly light-tight. A shade is fitted with struts for adjusting its angle whilst the light is an oil-lamp with outside adjustment of the burner. The price is 5s.

THE WATCH-POCKET CARBINE CAMERA.

(Sold by W. Butcher and Sons, Ltd., Camera House Farringdon Avenue, London, E.C.)

The designation, "watch-pocket," of this camera is an indication of its small dimensions when closed. These latter are under 5 x 3¼ x 1 inch, which, it will be admitted, are small for a roll-film camera taking a picture 2¼ x 2¼ inches. The camera carries a spool of the standard 2¼-inch size for six exposures. It is fitted with an Aldis "Uno" anastigmat of $f/7{\cdot}7$ aperture, mounted in an everset diaphragm shutter, which gives three instantaneous speeds in addition to bulb and time exposures. The lens is provided with an iris diaphragm, giving apertures from $f/7{\cdot}7$ to $f/32$. One very commendable feature of the apparatus is the focussing scale, graduated

for distances from infinity to 3 ft. In our own trials of the camera, using the lens at full aperture, we found the scale to be quite accurately marked, and a further good point about it is that, owing to the focussing mechanism used, the movement of the pointer on the focussing scale is twice that of the lens itself, a feature which conduces to accuracy when working with a lens of such short focus as 3 inches. The camera automatically stops at the position for infinity when pulled out upon the lens front, whilst to close the instrument it is necessary only to push the lens-front back upon the runners of the hinged base. The support of the lens-front being itself hinged, the lens, shutter, and finder stow themselves away

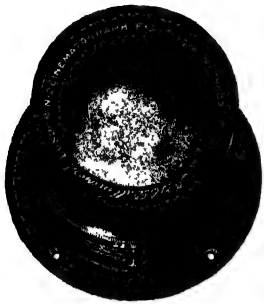


comfortably when the extension base is turned back. The watch pocket "Carbine" is thus a little camera, which goes a step further than other low-priced pocket cameras, inasmuch as it provides a means of focussing quite near objects and is well adapted for use in giving time exposures when a support can be provided in the shape of some flat rigid surface or by a tripod, for the use of which latter a bush is provided. Messrs. Butcher issue it, as we have described it above, at the price of 45s., and supply it also fitted with the "Compound" shutter at £3 7s. 6d. A suitable carrying case of brown leather costs 3s.; whilst for 6s. 6d. a convenient enlarging box, giving half-plate prints with a pleasing white margin, is supplied. Our own exposures gave us excellently sharp negatives, and we have no hesitation in signalising the camera as one with which really satisfactory work can be done.

AN F. 1·9 CINEMATOGRAPH LENS.

(Made by J. H. Dallmeyer, Ltd., Church End Works, Wil esden, London, N.W.)

This special objective for cinematograph work is of 3 in. focal length and of the very great aperture of *f*/1·9. The diameter of the lens tube is 2 in., a small dimension which is rendered possible by using a large number of leaves in the iris diaphragm. This latter is scaled for working apertures from *f*/1·9 to *f*/ 8. Simply by turn

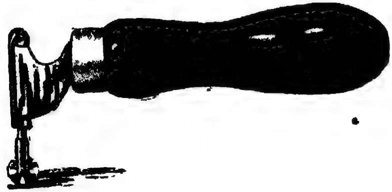


ing the lens in its mount, focussing may be done for distances from infinity to 6 ft. A lens of such great aperture as this is equal to the many occasions when cinematograph films require to be taken under trying conditions, such as by artificial light or very late in the day. The price of the objective is £7 7s.

THE WHEEL SWIVEL TRIMMER.

(Sold by Kodak, Ltd., Kingsway, London, W.C.)

For the trimming of circle and oval prints this is a most convenient tool in the photographer's printing room. The cutting-

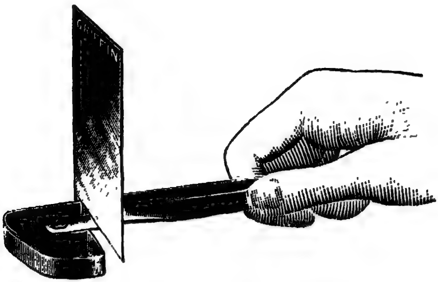


wheel, of $\frac{5}{16}$-inch diameter, runs on a hardened steel screw, mounted in a stock of nickelled brass. The wooden handle affords a firm grip of the trimmer, and in practice we find the accessory to perform its work exceedingly well The price is 2s. Spare wheels, 3d each, or with spindle, 1s. each.

THE "FLASHETTE" LAMP.

(Sold by John J. Griffin and Sons, Ltd., Kingsway, London, W.C.)

This improved model of the "Flashette" lamp is made to hold a larger amount of powder, and is fitted with a shield screening the flash from the lens. The lamp, as the illustration shows, is of small portable pattern, measuring only 7 by 2 inches. It is useful

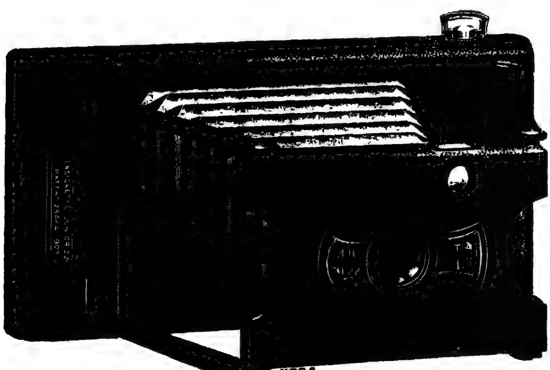


for readily lighting up dark corners in architectural photography, and for such flashlight work upon a small scale which does not call for the combustion of much powder. The lamp is fitted with a sparking-metal ignition, and is sold at 2s.

THE ENSIGNETTE JUNIOR NO. 2 J POCKET CAMERA.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

For the use of those preferring a camera of larger size and willing to sacrifice the vest-pocket portability of the ordinary



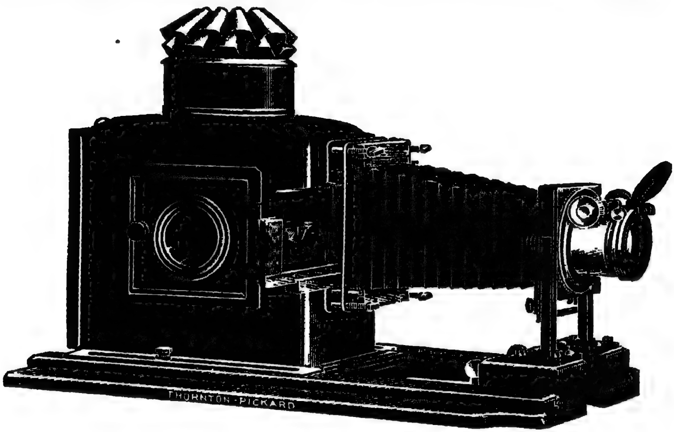
"Ensignette," Messrs. Houghtons have brought out a model of similar pattern, but of wooden body, and taking pictures $3\frac{1}{4} \times 2\frac{1}{4}$

inches. Like the ordinary "Ensignette," it is instantly made ready for use by pulling out the front upon the pair of struts. It is fitted with single lens provided with diaphragms $f/11$ and $f/22$, and everset shutter, which is adjustable to give time exposures by keeping the lever down for the time required. The finder is of the ground-glass pattern, and the back of the camera makes good provision for the use of the roll film, of which a 7-exposure daylight spool costs 1s. The price is 15s. 6d. Extra, for direct-vision finder, 2s. 6d.

THE UNIVERSAL PROJECTION AND SCIENCE LANTERN.

(Made by The Thornton-Pickard Manufacturing Co., Ltd., Altrincham.)

This new introduction is a lantern designed for the exhibition both of slides and chemical or physical experiments. When used for the latter purpose the bellows is removed, a very neat fitment



allowing of its instant detachment. The lantern has long extension by a very rigidly moving baseboard, and the lens-front is supported on uprights of great strength, which ensure very steady projection on the large scale for which the camera, by its long extension, is well fitted. A strongly made large-size lantern body with large ruby window is a special feature, and the carrier stage is of special construction with adjustable tension springs, by which the carrier is fixed solidly in place after its position has once been adjusted. The 4-inch condenser allows of the light being placed a good distance away from it, whilst the projection lens is a double achromatic of 6 inches focus, its inner tube allowing of the use of lenses of greater focal length. For its excellent design and construction the lantern is very moderately priced at £3 15s.

THE "GLOBUS" PORTABLE ELECTRIC LAMP.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

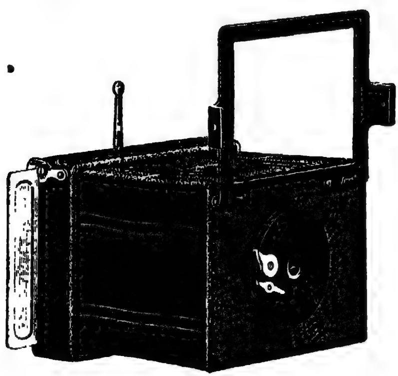
Strictly speaking, this is not a lamp, but a safelight, made in ruby pot glass, which fits in a metal holder by a species of bayonet joint, projections being moulded on the glass. The holder is affixed in an instant to any ordinary electric light fitting simply by with-

drawing the lamp, passing the holder over the fitting, and replacing the lamp. The whole then forms a light-tight dark-room lamp, which serves excellently for developing or changing plates, and provides a great convenience for those doing this work in a hotel bedroom, or using a bath-room at home for their photography. The price of the complete accessory is 3s. 6d.; extra globes, 2s. 6d. each

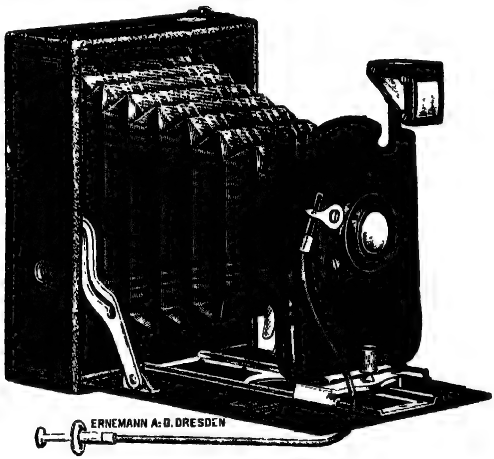
ERNEMANN FOLDING POCKET AND ROLL-FILM CAMERAS.

(Sold by Chas. Zimmermann and Co., Ltd., 13, Bartlett's Buildings, Holborn Circus, London, E.C.)

The "Lilliput" is a pocket instrument of the very slimmest dimensions for plates of the popular 60 x 45 mm. size. When



folded the camera is barely $\frac{3}{4}$ inch in thickness, whilst it measures about $3\frac{1}{2}$ x $2\frac{1}{2}$ ins. over-all. It is entirely of metal, the front being held firmly extended by means of two hinged metal plates within the camera. The finder is of the accurate full-size direct-vision or iconoscope type, provided with sighting rod on the back frame. A single lens is mounted in a shutter of the simplest pattern, giving one instantaneous speed, and time exposures by keeping the release lever down as long as the plate is to be exposed. The camera is made for use with single metal slides, and is provided also with a focussing screen of celluloid. Though issued at the very low price of 7s. 6d., complete with one single dark-slide the camera is not in any sense a toy, but capable of producing really satisfactory photographic work within its limits.



The Ernemann Model 1 series of folding cameras includes four sizes, from $3\frac{1}{2}$ x $2\frac{1}{2}$ to half-plate. While issued at the very moderate prices of from £1 10s. to £3 10s. the cameras are very well made, and are equipped in a way amply sufficient for the purposes of those who do their photography in the good light which usually prevails during the holiday season. The camera body is covered in a black imitation leather, has black leather bellows and a strong baseboard, and U-form front of black enamelled metal. The rising front is self-locking and has ample range of movements, whilst there is also rise landscape way of the plate. The shutter gives time and bulb exposures and three instantaneous speeds, and the price of the camera includes a very efficient focussing hood and two single metal slides. With Ernemann $f/11$ R.R. lens the prices in the four sizes mentioned above are £1 10s., £1 15s., £2 10s., and £3 10s. For

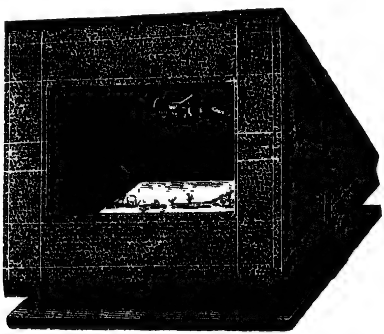
the $3\frac{1}{2}$ x $2\frac{1}{2}$ size a film pack adapter costs an extra 8s., whilst in the quarter-plate, postcard, and half-plate sizes the price of an all-metal film pack adapter is 6s., 12s., and 15s. respectively.

The Ernemann Model 1 roll-film cameras are of a quite similar type of construction, save that the body is built to hold the roll-film spools. The smallest size is the popular vest-pocket for $4\frac{1}{2}$ x 6 cm. pictures, price 55s. with Ernemann *f*/6·8 "Aplanat" in "Automat" shutter. In the larger size of $3\frac{1}{2}$ x $2\frac{1}{2}$, the camera is made for both plates and films. Price £3 5s. with lens and shutter as in the smaller model, or £3 15s. with the "Sector" shutter. Both series are really well made cameras, the price of which causes one to reflect upon the immensely greater value in cameras which the amateur photographer to-day can obtain as compared with the purchaser of only three or four years ago.

THE ASHFORD AUTOCHROME VIEWER.

(Made by J. Ashford & Son, Ltd., 179, Aston Road, Birmingham.)

A very convenient pattern of viewing cabinet for Autochrome transparencies. The Autochrome is placed in the carrier, which



side of the apparatus is directed towards the light, the Autochrome being then seen in the mirror. The whole accessory can be tilted so as to secure the best light. The carrier is made reversible for upright or oblong pictures, and is fitted with a carrier to allow of the next size larger transparency being accommodated. The whole packs into a small space when not in use.

THE PLANEX, "DE LUXE," AND FOLDING CAMERAS.

(Sold by the City Sale and Exchange, 93-94, Fleet Street, London, E.C.)

In this new model of reflex camera, sold complete with three excellent double slides at £10 10s. in the quarter-plate size, without lens, the extension is 11 inches. There is rack and pinion rise of front and an excellent large lens shade, which forms a cover to the lens when the camera is not being used. An excellent feature is

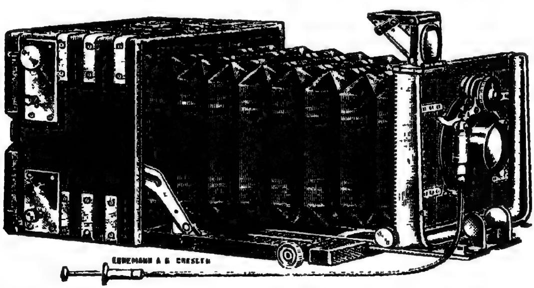
the provision with the rotating back of an automatic mask, working under the focussing screen, which shows the shape of picture, landscape or upright, corresponding with the position of the back. The mirror is of the type which is raised by pressing down the shutter release, or, in other words, the operation of the camera when making an exposure is to press down the lever which first raises the mirror and then releases the shutter, the mirror falling again by its own weight. The focal-plane shutter is a very quick wind, and is readily adjusted to different widths of slit by winding a supplementary pinion head. It is likewise quickly set to time, the mirror being held in the up position when making time exposures with the camera placed on a tripod, in which case focussing is done with perfect convenience on the ground glass supplied with focussing hood on the back of the camera. The camera is also made in the $3\frac{1}{2} \times 2\frac{1}{2}$ size, price £8 5s., and in two stereoscopic patterns, one taking plates 45 x 107 mm., price £10 10s., and the other plates $6\frac{3}{4} \times 3\frac{1}{4}$, price £14 5s.

The "Planex" folding reflex camera, noticed in a previous "Almanac," is now issued with a new shutter, in which alteration of the speed is made by pulling out about $\frac{1}{4}$ of an inch a milled head and turning it to the required speed. The shutter is also readily set to give time exposures. In the quarter-plate size, with three double dark-slides, but without lens, the price is £16 10s.; in postcard size, £21 10s.

THE ERNEMANN TROPICAL HAND-STAND CAMERA.

(Sold by Chas. Zimmermann and Co., Ltd., 13, Bartlett's Buildings, Holborn Circus, London, E.C.)

This camera is a special form of the Ernemann VI. hand-stand camera, specially made in teak and brass-bound for use in hot



climates. Both the woodwork and the bellows are specially impregnated, and the lens panel, baseboard, etc., strengthened by inlet brass. The camera has very great rise of front each way of the plate, folding reversible finder and two shutters, the Ernemann focal-plane in the back, and a between-lens shutter on the front.

Of light build the weight is less than 60 ozs., whilst the size when folded comes under $6\frac{1}{2}$ x 5 x $3\frac{1}{2}$ inches. Fitted with Ernemann $5\frac{1}{4}$-inch $f/6$ anastigmat the price, with "Bob" shutter, is £11 5s., or £15 15s. with "Stereo-Automat" shutter and pair of $3\frac{1}{2}$-inch $f/6$ lenses. With all three lenses and both shutters the price is £20 5s.

THE "SANDCO" FOCUSSING MAGNIFIER.

(Sold by Staley and Co., 24, Thavies Inn, Holborn Circus, London, E.C.).

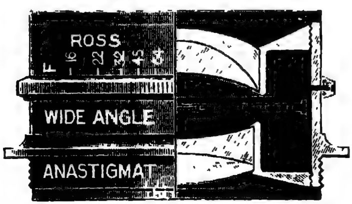
A very handy form of focussing magnifier is a new introduction of Messrs. Staley and Co. A useful feature of it is the stout rubber flange by which the magnifier grips to the focussing screen simply on being pressed against it. The magnifying power, about 3 or 4

diameters, is quite sufficient for ordinary photographic work, where sharp focus is required and where the photographer does not require to spend the time which a high-power magnifier calls for. Well made in polished brass, the price is 10s.

THE ROSS WIDE-ANGLE LENS.

(Made by Ross, Ltd., Optical Works, Clapham Common, London, S.W.)

In this wide-angle anastigmat, working at an aperture of $f/16$, a perfectly flat anastigmat image over an angle of from 90 to 100 degs. is obtained. Thus, in the case of the No 3 of $5\frac{1}{2}$ ins

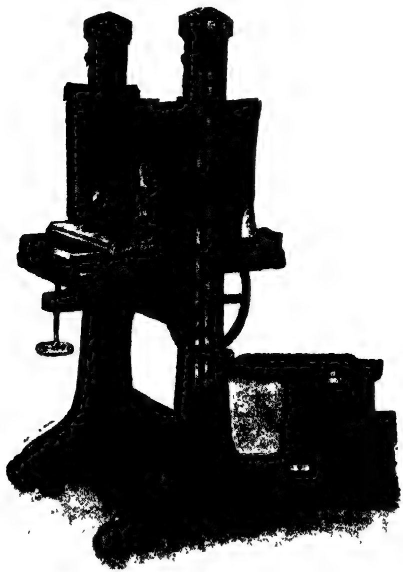


focal length, a half-plate is covered at the full aperture and a whole-plate at $f/32$. The price is £4. The series includes seven lenses, from $3\frac{1}{4}$ to $12\frac{1}{4}$ ins. focus, the prices running from £3 4s. to £9 5s.

THE 1914 "FRAM" STUDIO STAND.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

In the latest model of this stand, reviewed in a previous "Almanac," a more handsome shape is adopted, whilst the working features of the stand remain practically unaltered. As before, the camera is supported on a balanced table, which latter is raised



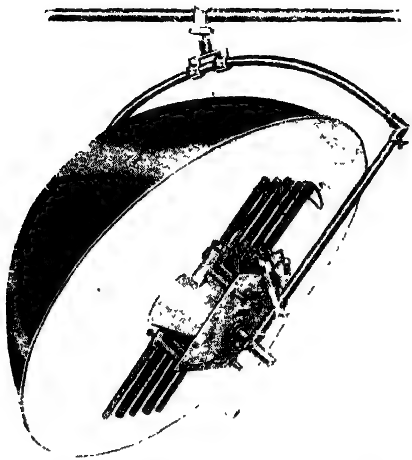
and lowered by quite silent gear pinions. These serve to lower the camera to within 20 inches of the floor or to raise it breast high. The price remains the same—namely, £13 15s.

A NORTHLIGHT LAMP FOR SMALL STUDIOS.

(Made by Marion and Co., Ltd., Soho Square, London, W.).

Messrs. Marion have recently designed a special pattern of mounting for their "Northlight" portrait arc lamp, particularly for use in studios of small size, where it is important to economise floor space in installing artificial light. The multiple arc is mounted in a frame which carries the metal reflector attached to a cup and ball joint, the whole travelling on a stout metal rod. The drawing plainly shows the arrangement, and in regard to it it may be noted that it is applicable to any "Northlight" arc con-

taining two pairs of carbons and upwards, not only to the 5-pair lamp illustrated. The price of the fitting, complete with reflector,

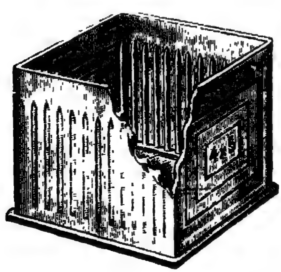


is £5 5s., and Messrs. Marion will be glad to supply specifications showing the best method of installing on receipt of dimensions of his studio from any photographer.

GLASS TROUGHS.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street Westminster, London, S.W., and 111, Oxford Street, London, W.)

For development or fixing, these glass troughs are a very inexpensive and convenient means of saving space and time in the dark-



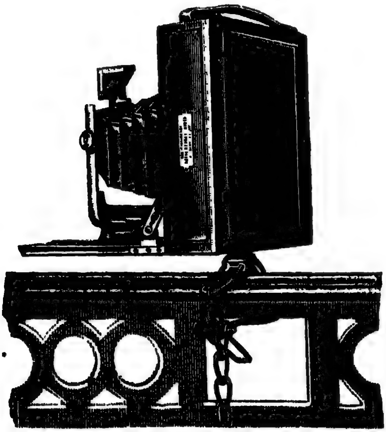
room, They are of pressed glass, and thus are strictly of the size required, the plates sliding readily into the grooves, but being

incapable of slipping from one groove to another, as is frequently found to be the case with porcelain tanks made by a firing process. Moreover, the tank allows of about three-quarters of an inch above the level of the plates, so that the latter are fully covered by the solution without mess from the developer or fixer splashing over the sides. To take twelve plates the price in quarter-plate is 2s. 6d.; in 5 x 4, 3s.; and in half-plate, 4s. 6d.

THE "POCKA" CAMERA SUPPORT.

(Sold by John J. Griffin and Sons, Ltd., Kingsway, London, W.C.)

The use of this little accessory is well shown in the drawing. The "Pocka" consists of a collapsible clip of stout nickelled wire fitted with a screw for the bush of a small hand camera. The latter can



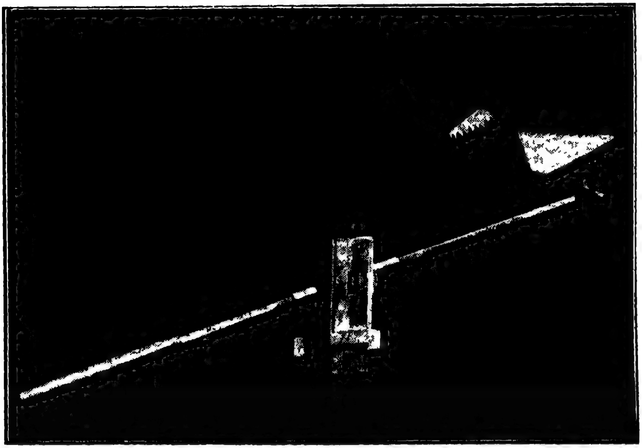
be attached to the accessory and thus secured to a support, such as the rail of a fence or gate, branch of a tree, etc. The price of the fitment is 3s. 6d.

THE "BRAM" STUDIO VIGNETTER.

(Made by Wahltuch, Smith, and Co., 30, Chapel Street, Manchester.)

This piece of apparatus can be fitted to any studio camera simply by means of an ordinary clamp. It provides the means of making vignette negatives of any kind from the dark or Egyptian vignette to that of the customary variety. This is done by using one or other of four vignetting masks supplied with the apparatus and fixed by means of ordinary paper fasteners to a square shaft which moves in front of the lens. The shaft is caused to rotate on its axis by turning the handle at the back end of the vignetter, the

movement being similar to that of a limelight jet and quickly bringing any one of the masks into operation. In addition, the vignetting mask may be moved towards and away from the lens, may also be tilted upwards or downwards, and, lastly, may be



angled above or below a horizontal line, thus providing a full range of movements, all of which are controlled by the operator whilst his eyes are fixed on the focussing screen. The apparatus is very substantially made in brass and polished wood, and its working parts are of the simplest kind. Price 30s.

THE BUSCH "TELAR" REFLEX CAMERA.

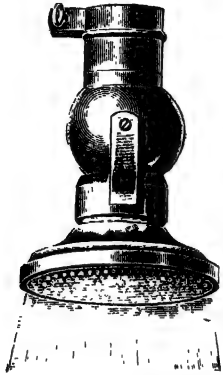
(Made by Emil Busch Optical Company, 35, Charles Street, Hatton Garden, London, E.C.)

In the latest model of the Busch "Telar" reflex several minor improvements have been made since we first reviewed this camera in a previous ALMANAC. The camera, as our readers may recollect, is somewhat of a special type of reflex, inasmuch as the hood is fitted with a mirror, in which the image upon the focussing screen may be viewed with the camera held at the eye level. An aperture, closed by a leather flap when not in use, is provided for this purpose. The camera is now fitted with the "Bis-Telar II" of 22 inches focal length and of *f*/7 aperture, yet although providing this great focal length, the extension of the camera is only 8¼ inches. Complete with three double dark slides the price of the complete instrument inclusive of the "Bis-Telar" lens is now £27 10s.

NEGATIVE SPRINKLERS.

(Sold by the Westminster Photographic Exchange, Ltd., 119, Victoria Street, Westminster, London, S.W., and 111, Oxford Street, London, W.)

A very handy pattern of attachment for the tap on the darkroom sink is shown in the drawing. It consists of an anti-splash nozzle,

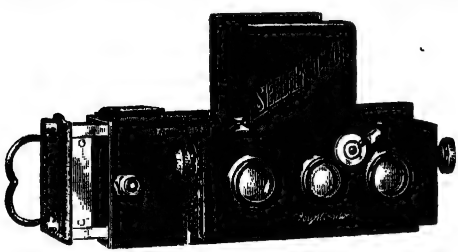


which is screwed on to the tap, and serves for use when mixing solutions, etc. For rinsing negatives, prints, etc., a rose-jet is brought over the nozzle, and the water is then distributed in a fine spray. Price, in nickelled metal, 2s.

THE STEREO-FLECTOSCOPE CAMERA.

(Sold by Voigtländer and Sohn, 12, Charterhouse Street, London, E.C.)

This camera is a revised and much improved model of the "Stereo-photoscope," reviewed two years ago in the "Almanac." The makers have now embodied in it a reflex instrument, providing a central



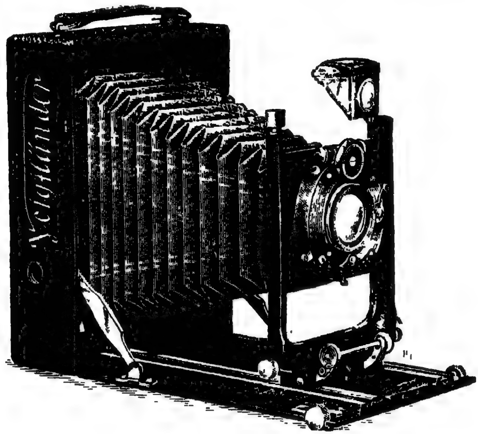
lens which permits the worker to view and to focus the picture which is taken by the pair of stereoscopic objectives. This is done by mounting a fixed mirror in the central portion of the camera, and providing a focussing movement which actuates all three lenses

simultaneously. In this form the camera should prove even more popular among those using the 107 x 45 mm. plates for stereoscopic work. The camera is fitted with an excellent drawer-pattern of changing box, and in every respect of most rigid construction, ample rise of lenses, adjustment of shutter, etc., is an instrument of the highest class. Complete with a pair of $f/4{\cdot}5$ "Heliars," and changing box for 12 plates, the price is £22 10s.

VOIGTLÄNDER FOLDING HAND-CAMERAS.

(Sold by Voigtländer and Sohn, 12, Charterhouse Street, London, E.C.)

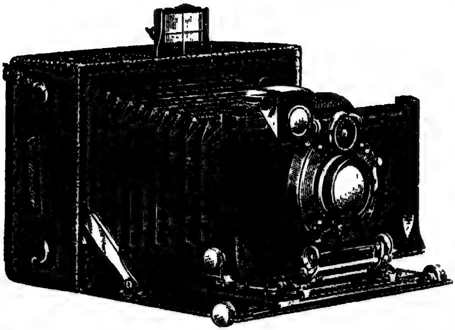
Two new models of the all-metal type of hand-camera, of which Messrs. Voigtländer have issued a number of excellent patterns, are new introductions for 1914. The "Tourist" is for plates or film



pack of 6 x 4 inches (10 x 15 cm.). It is an instrument of double extension, 14 inches from lens to plate, and exceptionally well equipped as regards movements, there being ample rise and cross front adjustment of lens, in both cases by screw. There is focussing scale when working at the single extension, and infinity mark for the use of the half-lens at double extension of the camera. The shutter is the "Compound," and the finder ot the brilliant reversible pattern with level. Complete with three single metal dark-slides, well-hooded focussing screen and "Radiar" $f/6{\cdot}8$ anastigmat, the price is £7 12s.; with $f/4{\cdot}5$ "Heliar" of $7\frac{1}{8}$-inch focal length, £14.

The other camera is a new model, also of 6 x 4 inch size, of the well-known Voigtländer "Alpine." The build of the camera, landscape way, fits it for stereoscopic work, as also for wide-angle panoramic views. Like the "Tourist" it is strongly constructed of light metal, and provides extension of 10 inches. There is ample rack and pinion rise of front, direct-vision finder in addition to a

brilliant finder on the lens front. With Series III. "Collinear" anastigmat in "Compound" shutter the price, inclusive of six single metal slides and hooded focussing screen, is £15 5s. The camera is



also supplied with a pair of 4-inch Series III. "Collinears" in "Compound" stereoscopic shutter, price £19 5s., or with all three lenses in triple "Compound" shutter, price £27 5s.

THE "HELOMAR" $F/3{\cdot}2$ ANASTIGMAT.

(Sold by Voigtländer and Sohn, 12, Charterhouse Street, London, E.C.)

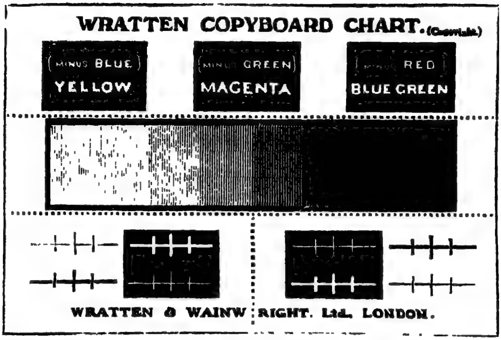
Under this name is introduced a new anastigmat of the extreme aperture of $f/3{\cdot}2$ for foci up to 6 inches; of $f/3{\cdot}5$ for the longer foci up to $9\frac{1}{2}$ inches. As shown in the drawing the lens is of the triplet construction, and is introduced particularly for cinematograph work in the smaller sizes, and for ordinary photographs over a moderate angle, the 6-inch focus being recommended for the

quarter-plate. In the ordinary mount, with iris diaphragm, the price of this size is £9, or £10 in focussing mount. The lenses are also supplied in plain cylinder mounts for projection purposes. As an instrument for photography at the highest speed, where the utmost illumination is of greater importance than depth of focus, the "Helomar" is certainly an instrument which, by its ultra large aperture, has special claim to notice.

THE WRATTEN COPYBOARD CHART.

(Made by Wratten and Wainwright, Ltd., Kodak House, Kingsway, London, W.C.)

To the three-colour block-maker, this chart is a most useful check upon the correct exposure and the correct working of filters in making the three negatives. The card bears patches of the complementary inks. These serve to identify each negative. It also bears a graded strip of neutral grey, which should appear of equal density in all three negatives if the exposure is correct. This test thus serves as a check against mistakes in exposure, the operator



being liable to think, from the appearance of one negative, that the exposure has been too short or too long, whereas the true cause may be the nature of the colour of the original. The test assumes the use of fairly correct inks in printing from the blocks, but even where incorrect inks have to be used the graded strip is still a useful indication in the making of the negatives, it being obtained of greater or lesser density as found to be required by the inks. The price of the chart is 1s.

LEONAR FOLDING HAND-CAMERAS.

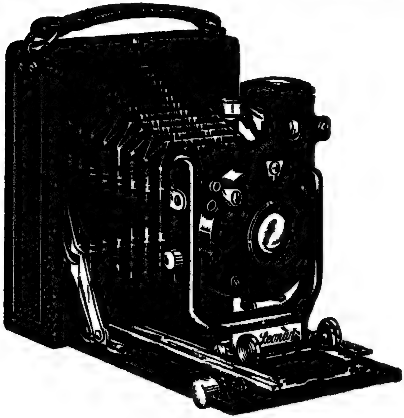
(Made by Arndt and Löwengard, 9, Fore Street Avenue, London, E.C.)

In the series of these cameras submitted to us it is evident that the makers recognise the type of instrument which is most in favour and most saleable among the generality of amateur photographers of moderate purchasing power. The cameras largely follow the lines of folding instruments which have come upon the market of late years, and at the prices at which they are issued are remarkable value. They are of the solid U-front pattern, with rise and cross front movement, brilliant reversible finder and level—in short, with the movements which are now expected by purchasers of even quite inexpensive cameras. Thus in the A II. pattern for $3\frac{1}{2} \times 2\frac{1}{2}$ inch plates the price, with three single metal slides and "Auto" shutter with two instantaneous speeds, is £2 8s. 6d., or £3 9s. 6d. with "Compound" shutter, in each case with *f*/8 R.R. lens.

A model which is a really good camera at an extremely low price is the C VI. of quarter-plate size, and costing £1 4s. with R.R.

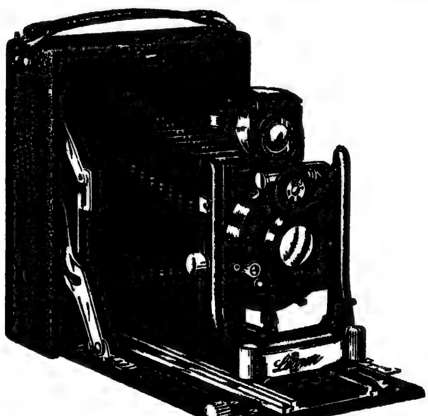
lens, or 16s. 6d. with $f/16$ single lens. It is fitted with shutter giving one instantaneous speed, in addition to bulb and time.

The series likewise includes the more expensive and elaborate



THE A II.

models of both single and double extension, such as the B II. and B III., of quarter-plate and postcard size, and costing, with R.R



THE B II

lens and "Leonar" two-speed shutter, £3 6s. and £3 respectively The Leonar construction, it should be added, is also applied to several film camera models.

Nicola Perscheid

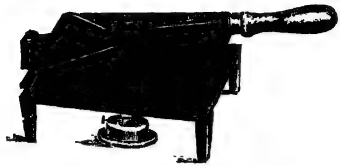
PORTRAIT-STUDY

from an Autochrome-Photo
taken with ZEISS-TESSAR 1 : 3,5 f = 30 cm

THE "OMEGA" DRY MOUNTING PRESS.

(Sold by George T. Collis, 57, Hatton Garden, London, E.C.)

This useful pattern of dry-mounting press for amateur use has a pressure surface of 8 x 6 inches. But, in consequence of the open construction of the press, mounts of considerable size can be inserted in it, and the press used, for example, for mounting several small prints on a large mount. Moreover, the mounting of the



lever handle which supplies the pressure causes the plate to come flat with the heated base whatever the thickness of the mount. The press is supplied complete with spirit lamp and thermometer, price 12s. 6d. It can be used equally well with any small ring gas burner. Apart from its proper purpose of dry-mounting, it is a serviceable little appliance for plate-marking prints.

BUSCH STEREODIOSCOPE.

(Made by the Emil Busch Optical Co., 35, Charles Street, Hatton Garden, London, E.C.)

This is a very handy form of stereoscope for transparencies of 45 x 107 mm., or 60 x 130 mm., such as are made from the negatives taken with the "Verascope" and other metal stereoscopic pocket

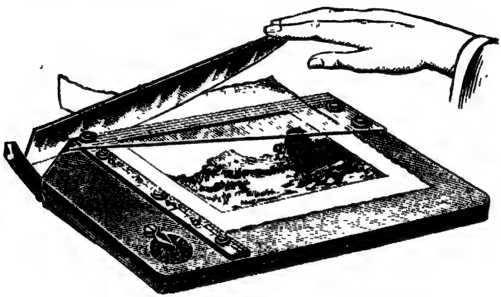
cameras. The transparency is instantly placed in position by laying it within a metal rebate and fixing, by a couple of clips, the hinged back provided with ground glass diffusing screen. The instrument is made with a separation of the optical centres of 64 mm. ($2\frac{1}{2}$ inches), but in consequence of the large lenses employed

it can be used by persons with a greater or less separation of the eyes. It is supplied in three models :—I. For 45 x 107 mm. plates, with plano-convex lenses, price 13s. 6d. II. For the same size of plate, but with acromatic lenses and focussing adjustment, price 18s. III. For 60 x 130 mm. plates, with achromatic lenses and focussing movement, price 27s.

THE "TRIMMERETT" TRIMMING BOARD.

(Sold by the Adhesive Dry Mounting Co., Ltd., 27-28, Fetter Lane, London, E.C.

A larger size, with 10-inch blade, of this useful form of trimming board has been introduced. Each edge of the print is trimmed off with the greatest accuracy, the full print being in view at each stroke of the knife. The print lies under a celluloid sheath, the edge of which next to the knife is ruled with parallel lines, to one or other of which the edge of a picture, which has been printed



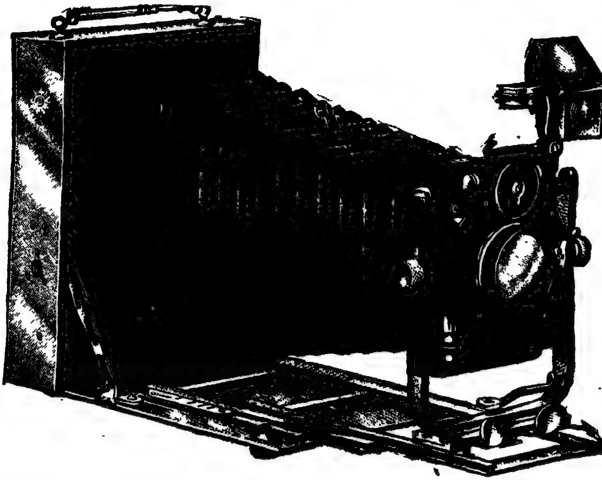
through a mask, may be set in order to provide a white margin up to ½-inch width. The trimmer is one which is particularly suitable for cutting tints to be superimposed for the multiple mount effect, of which tints the Adhesive Company have now about 150 different depths and colours, all of exceedingly suitable character for the tasteful mounting of photographs. The price of the new trimmer is 10s. 6d.

THE BUSCH TROPICAL FOLDING HAND CAMERA.

(Made by the Emil Busch Optical Co, 35, Charles Street, Hatton Garden, London, E.C.)

This is a camera made throughout of special non-rusting metal. The body, base-board, and dark-slides are of German silver; the other part of nickelled brass. Only the frame of the focussing screen is of wood (teak), and this is reinforced by a metal plate which lies flush with the metal back frame of the camera. The only perishable part of the instrument, namely, the leather bellows and focussing hood, are specially impregnated as a protection against the attacks of insects in tropical climates. Yet, despite its metal construction and long extension, 16 inches, in the only size

made, namely, quarter-plate, the camera is of quite normal weight. It has ample rise of front and cross front movement, is fitted with very stout bushes for upright and landscape pictures, and is throughout of the highest mechanical construction. Closed, it measures under 6 x 4¼ x 2¼ inches. Complete with six German silver plate holders, the price, with "Compound" shutter and



"Omnar" $f/7.7$ anastigmat of 5⅛-inch focus, is £10 17s. With "Leukar" $f/6.8$ anastigmat, £11 12s.; or with $f/4.5$ "Omnar," £12 12s.

THE "HYPAR" PORTRAIT LENS.

(Made by C. P. Goerz, Optical Works, Ltd., 1 6, Holborn Circus, London, E.C.)

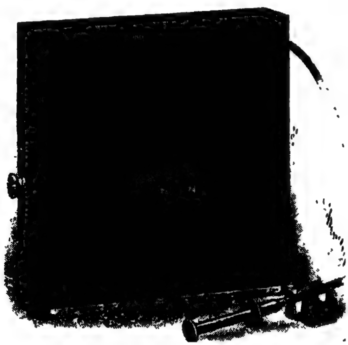
This new lens is of the extreme aperture of $f/3{\cdot}5$ in the case of the instruments of 12 and 14 ins. focal length; in the others of the series, from 14 to 24 ins. focal length, the aperture is $f/4{\cdot}5$. The lens is of the triplet type, consisting of one negative placed between two positives. This construction allows of the glasses being thinner than is customary in anastigmat objectives, with the result that the lens, as a whole, is of a high degree of transparency. The construction, we learn, also allows of highly durable glasses being employed. The "Hypar" is remarkably free from tendency to internal reflections, and on this account is of special value in portraits taken against the light. In the case of the $f/3{\cdot}5$ lenses the field is free from astigmatism over an angle of 35 degrees; in the case of the $f/4{\cdot}5$ over an angle of 45 degrees. While the lens thus yields exceedingly good definition over an angle which is more than sufficient for portraiture having pleasing drawing, the

results have a certain quality which distinguishes them from the biting sharpness of the ordinary anastigmat, and should ensure the "Hypar" enjoying great popularity as a lens for studio and at-home portraiture. The price of the 12-inch lens, suitable for a 6 by 4 plate, is £27 10s.; that of the 14-inch $f/4{\cdot}5$ lens, suitable for 8 by 6 plate, £24.

AN ALL-METAL STUDIO FLAP SHUTTER.

(Made by J. H. Dallmeyer, Ltd., Church End Works, Willesden, London, N.W.)

Their studio shutter of the single-flap type for attachment within the camera has been further improved by Messrs. J. H. Dallmeyer, Limited, by fitting it with an extra stout Bowden-wire operating mechanism which avoids the use of rubber in all parts of the apparatus, saving only the studs which serve to secure it to the



lens-mount. The movement of the shutter is most certain and practically noiseless, whilst nothing could be simpler or more reliable than the working part. Price, complete with 5 ft. of actuating wire, £1 5s. 6d., in sizes from 2½ ins. to 4 ins.; £1 8s. in sizes from 4½ ins. to 6 ins.

THE ANSCO AMATEUR PRINTING MACHINE.

(Made by Ansco, Ltd., 143-149, Great Portland Street, London, W.)

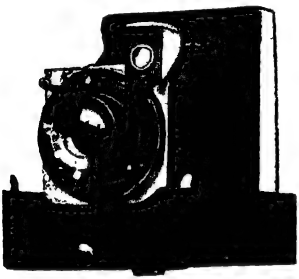
This box printer takes negatives up to half-plate size. It is fitted with a hinged pressure board, the two strong springs on which provide most intimate contact between the negative and the printing paper. Pressure on the board operates the switch by which the red lamp within the box is switched off and the large white electric lamp switched on. A very good feature of the printer is a hook form of catch, by which the pressure board can be kept held down. This is convenient for exposures on gaslight paper, where the time may be longer than is convenient when operating the

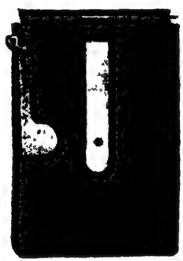
printer entirely by hand pressure. The box is provided with a red safelight, which affords a convenient means of handling the exposed and unexposed papers. The price of the printer, complete with the two electric lamps and with 6 ft. of flexible cable for attachment to any electric lamp holder, is 35s.

THE "GLEANER" POCKET CAMERA AND "DAY-LOAD" FILM SLIDE.

(Made by the A-kla Co., Sale, Cheshire.)

The No. 2 "Gleaner," of $3\frac{1}{2}$ by $2\frac{1}{2}$ inch size, is similar in design to that reviewed in last year's "Almanac," but is fitted with screw focussing, reversible brilliant finder and R.R. lens. As in the previous model, the camera folds up most neatly into its tray-form baseboard, the lens being entirely protected when the camera is closed. Including one single dark-slide, the price of the No. 2 "Gleaner" is 25s. The "Day-Load" system of using film consists





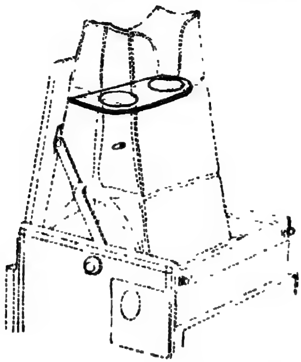
in the use of a special metal adapter, into which is loaded the stout paper envelopes, each holding a strip of film doubled on itself, and thus serving for two exposures. The film envelope is placed in the inner frame of the adapter, this inner frame being then held in the outer casing of the adapter, which fits in place at the back of the camera like a single metal dark-slide. On pulling the paper flap of the film envelope the latter is drawn off, leaving the film ready for exposure in the camera. After exposure the envelope is pushed back over the film with a little dexterity and the exposure of the second film in the envelope is then effected in the same way. The price of the adapter is 7s. 6d. in $3\frac{1}{2}$ by $2\frac{1}{2}$ size; 8s. 6d. in quarter-plate size. The price of the films per dozen exposures is 1s. 9d. and 3s. respectively.

METRON BINOCULAR FOCUSSING GLASSES FOR REFLEXES.

(Made by Chas Baker and Co., 244, High Holborn, London, W.C.)

Messrs. Baker have designed an extremely light and handy form of binocular focusser for fitting to the hood of any reflex camera. The glasses are mounted in a light metal plate, which is hinged to

the hood, and folds up inside when the latter is closed. On the hood being erected the focussing glass automatically springs into position. The price is 17s. 6d. when fitted with ordinary magnifying lenses; 22s. 6d. when fitted with compound astigmat lenses.



At these prices customers' own optical prescriptions as to glasses can be carried out. The sole agents for the glasses are Messrs. Marion and Co., Limited, to whom all inquiries should be addressed.

A RUBBER CONNECTION FOR PRINT WASHERS.

(Sold by the Altrincham Rubber Company, Mossburn Buildings, Stamford New Road, Altrincham.)

This useful accessory consists of a stout rubber tube 2 ft. in length, and fitted with strengthened ends, one of which is made to fit over a ½-in. tap and the other over the ⅜-in. projecting tube on

the washer. The connector thus makes it an easy matter to fit a washer to the ordinary tap without the trouble which is often experienced in getting and fitting ordinary rubber tube. The price is 1s. 3d.

Makers of Photo-Materials and Booklets issued free by them.

The section devoted to "Makers' Formulæ" in previous editions of the ALMANAC having undoubtedly been an indication of the firms manufacturing the various products, the following synopsis has been prepared. It shows the firms by whom a particular class of sensitive material is manufactured; or, in some cases, firms acting as agents therefor. Following it will be found a list of the booklets, etc., issued gratuitously by plate and paper makers, and obtainable by direct application to them.

Plates (other than Lantern) and Films

Austin Edwards
Birmingham Photo Co.
Cadett
Elliott
Gem
Ilford
Imperial
Jahr
Kodak
Leto
Lilywhite
Lumière
Marion
Mawson
Paget
Rajar
Warwick
Wellington
Wratten
Ziegler
Zimmermann

Lantern Plates

Cadett
Elliott
Gem
Griffin
Ilford
Imperial
Jahr
Kodak
Leto
Lumière
Marion
Mawson
Paget
Thomas
Wellington
Wratten
Ziegler
Zimmermann

P.O.P., Bromide and Gaslight Papers

Ansco
Any-tone
Bayer
Birmingham Photo Co.
Cadett
Challenge
Elliott
Gem
Gevaert
Griffin
Ilford
Illingworth
Imperial
Kentmere
Kodak
Kosmos
Leonar
Leto
Lilywhite
Lumière
Marion
Paget
Rajar
Rotary
Schaeuffelen
Takiris
Wellington
Ziegler
Zimmermann

Collodio - Chloride Paper

Gevaert
Halifax
Ilford
Kodak
Leonar
Leto
Lumière
Marion
Paget
Rajar
Rotary
Zimmermann

Self-Toning Papers.

Birmingham Photo Co.
Challenge
Elliott
Griffin
Ilford
Illingworth
Imperial
Kentmere
Kodak
Leto
Lilywhite
Paget
Rajar
Wellington
Zimmermann

Platinum Papers

Gevaert
Ilford
Kodak
Platinotype Co.

Carbon

Autotype Co.
Elliott
Illingworth
Kentmere

Miscellaneous Printing Papers

Gevaert
Halden
Marion
Paget
Rexam
Trapp
Wisto
Zimmermann

BOOKLETS, ETC., ISSUED GRATUITOUSLY BY THE PHOTOGRAPHIC TRADE.

ADHESIVE DRY-MOUNTING CO. LTD.—All about Dry-mounting.

ANSCO, LTD.—Professional Cyko Manual. A Year's Impression of Cyko.

ANY-TONE, LTD.—Warm Tones on Gaslight Paper.

AUTOTYPE CO.—First Steps in Autotype Printing
,, ,, Autotype Trichrome Tissues.

BAYER CO.—Photographic Papers and Products.

BIRMINGHAM PHOTOGRAPHIC CO., LTD.—The Plate, Photographic Bromoil.

ELLIOTT & SONS, LTD.—An Amateur's Guide to Plates, Roll-films and the Making of Prints.

GEM DRY PLATE CO., LTD.—The Question of a Plate.

GEVAERT, LTD.—Gevaert Platinum Paper and How to use It.
,, ,, Gevaert Gravure Paper.

GRANT, THOS. K.—Instructions for use of Autochrome Plates, Lumière Plates, Films, Papers, and Chemicals.

GRIFFIN, JOHN J., & SONS, LTD.—Notes on P.O.P. Printing.
,, ,, ,, ,, Sepia Carbon Tones on Bromide Paper
,, ,, ,, ,, Oil Pigment Printing.

ILFORD, LTD.—Ilford Plates. (Exposure, Developing, Intensification, etc.)*
,, ,, Every-Day Book of Common Failures Illustrated.*
,, ,, Ilford Exposure Tables.*
,, ,, Notes on Isochromatism.*
,, ,, Printing on P.O.P. and Self-Toning Paper.*
,, ,, Bromide and Gaslight Papers.*
,, ,, Lantern Slides on Dry Plates.*
,, ,, Ilford X-Ray Plates.*
,, ,, Dry Plates for Process Work.*

ILLINGWORTH & CO., LTD.—Guide to Photographic Printing.

IMPERIAL DRY PLATE CO., LTD.—Imperial Handbook.
,, ,, ,, ,, Faults in Negatives.
,, ,, ,, ,, Orthochromatic Photography.
,, ,, ,, ,, The use of Imperial P.O.P.

KENTMERE, LTD.—Hints for Carbon Workers.
,, ,, Hints and Wrinkles for Bromide, Gaslight and P.O.P. Workers.

KODAK, LTD.—The Velox Book.
,, ,, Border Printing on Velox Paper.

KOSMOS PHOTOGRAPHICS, LTD.—Kosmos Papers.

LETO PHOTO MATERIALS CO., LTD.—Handbook of Photography.*
,, ,, ,, ,, Lantern-Slide Making.
,, ,, ,, ,, Perfect Prints (on Self-Toning Paper).
,, ,, ,, ,, The Perfect Negative Boardoid Photography.

LILYWHITE, LTD.—Lilywhite Plates and Papers.

MARION & CO., LTD.—Marion's Plates and Papers.

MAWSON & SWAN, LTD.—Orthochromatic Photography. By Arthur Payne.
,, ,, ,, Lantern-Slide Making.

PAGET PRIZE PLATE CO., LTD.—Paget Prize Plates and How to Use Them.
,, ,, ,, ,, Paget Panchromatic Plates.
,, ,, ,, ,, Paget P.O.P. and How to Use it.
,, ,, ,, ,, Coloured Pictures on Hydra Self-Toning Ivorettes.
,, ,, ,, ,, Exposure Tables for Paget Plates.
,, ,, ,, ,, Paget Self-Toning Papers.
,, ,, ,, ,, Paget Colour Photography.

PLATINOTYPE CO.—Instructions for Platinotype Printing.
,, ,, Black Japine Platinotype.

VANGUARD CO.—Varnishing Negatives.
,, ,, Firelight Portraits.

WELLINGTON & WARD.—Wellington Photographic Handbook.
,, ,, Wellington Plates.
,, ,, Wellington Roll Films.
,, ,, Wellington Anti-Screen Plate.
,, ,, Wellington P.O.P.
,, ,, Wellington S.C.P. (gaslight paper).
,, ,, Bromide Printing.
,, ,, Wellington B.B. Paper.
,, ,, Lantern-Slide Making.
,, ,, Wellington X-ray Plates.

WRATTEN & WAINWRIGHT, LTD.—Photographic Dry-Plates, Filters and Screens.
,, ,, ,, Real Orthochromatism.
,, ,, ,, Lantern Slides.
,, ,, ,, Photo-Micrography.*
,, ,, ,, Screen-Negative Making on Dry Plates.
,, ,, ,, Radiography.

ZEIGLER, W.—Paragon (Schleussner) Handbook (Abridged Edition.)
,, Pyramid (Schaeuffelen) Bromide Papers.

ZIMMERMAN & CO., LTD., CHAS.—Agfa Handbook.
,, ,, ,, ,, Orthochromatic and Non-Halation Plates. By Dr. Andresen.
,, ,, ,, ,, Hints on Flashlight Photography.
,, ,, ,, ,, Magnesium Flashlight. By Dr. Andresen.
,, ,, ,, ,, Practical Hints on X-ray Photography.

* British penny stamp or International coupon should be sent for postage.

In the case of practically every manufacturing firm the instructions for the use of plates or papers contain much information as regards developers, development, manipulation, etc. Such printed instructions will be readily sent on application.

FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

ORTHOCHROMATIC PROCESSES.

(Most of the formulæ in this section are those used in the three-colour and process department of the L.C.C. School of Photo-Engraving, Bolt Court, London, E.C., to the Principal of which, Mr. A. J. Bull, we are indebted for assistance in arranging them in the present form.—Ed. *B. J. A.*)

Sensitisers for Gelatine Plates.

1.—*For blue-green and green.*

To sensitise up to wave-lengths, 5,500 A.U., a good dye is *acridine orange*, *N.O.* of the Leonhardt Farbwerke, Mülheim, Germany. It is used as directed below for green and yellow sensitising, except that ammonia must not be used.

The isocyanines mentioned below are also extremely good sensitisers for green, and are probably faster, but require suitably adjusted green filters when nothing beyond the green is required.

2.—*For green and yellow, but not red.*

To sensitise up to 5,900 A.U., *erythrosine* is still the best dye, though it leaves the plates somewhat insensitive to bluish green. The most suitable dye is that of Dr. Schuchardt, Goerlitz, or of Meister Lucius and Bruning, Hoechst, a/M.

One part of dye is dissolved in 1,000 parts of alcohol, and a bathing solution made as follows:—

Stock solution 1 : 1,000	100 parts
Water	400 parts
Ammonia (0·880)	5 parts

This is a 1 : 5,000 solution.

N.B.—Ammonia must not be used with acridine orange.

3.—*Green, yellow and red.*

To sensitise for all rays up to 6,200 to 6,400 A.U. the following are used:—

Orthochrome T, Pinaverdol, Pinachrome, or Homocol,

their order as red-sensitisers being as above.

A stock solution is made containing 1 part of the dye in 1,000 parts alcohol. The bathing solution contains:—

Stock solution	2 parts
Water	100 parts

This is a 1 : 50,000 solution.

The stock solution will keep, but the weaker bath will not. A red light is used, until it is seen that the solution has covered the plates, after which the operation must be continued in total darkness.

4.—*Extreme visible red.*

To sensitise for the extreme visible red, *pinacyanol* should be used. The operations can be done in a weak green light, passing the part of the spectrum between 5,000 and 5,300. The dye solutions are prepared exactly as those of Orthochrome T, etc. See above.

5.—*Panchromatic Plates.*

Use a 1-50,000 solution of a mixture of pinachrome and pinacyanol, viz., 3 parts pinachrome stock solution, 2 parts pinacyanol stock solution; water, 250 parts.

6.—*Infra re l.*

The best sensitiser for the infra red is *dicyanine*, which is prepared and used exactly as pinacyanol, except that the stock solution must not be added to the water until the very last moment, when everything is quite ready, and the plate can be immediately flowed with the solution, as the weak solution loses its sensitising power very quickly.

If ammonia is used with the cyanine sensitisers given in 3, 4, and 5, it must be quite pure, or fog will be produced. It is best to dispense with it, but if used the proportion is about 1 part per 100 of sensitising bath.

Practical Notes on Bathing.

The dye solution is prepared in a measure, the plates are dusted and laid in a flat porcelain dish, which is large enough to hold nearly twice the number of plates it is desired to sensitise at one time. These are put at one end of the dish; the dish is then tilted, and the dye solution poured into the other (empty) end, then the dish is tilted back, so that the dye solution sweeps over the plates in one even flow free from air bells. The dish is now gently rocked for three minutes, then the plates are removed and washed in a good stream of running water for at least another three minutes. Their sensitiveness and keeping quality will probably be somewhat greater if they are washed for ten minutes, but they will remain good for months, kept under proper conditions, after three minutes' thorough washing, if bathed according to the formulæ given above.

The water tap should be fitted with one of the small anti-splash filters, the fine wire gauze in which retains any solid particles that may be in the water.

After washing, the plate should be well swabbed with a wad of cotton wool, and then placed in a drying cupboard. The quicker drying takes place the better, so that if a current of warmed, filtered air, free from fumes, can be sent through the cupboard it is an advantage, though the absence of this convenience need not deter anyone from sensitising plates. Drying can be hastened by placing a dish of dry calcium chloride or quicklime at the top of the cupboard.

Sensitisers for Collodion Emulsion.

For Green and Greenish Yellow (Hübl).

Pinaverdol (1:500)	1 oz.	40 c.c.s.
Collodion emulsion	25 ozs.	1,000 c.c.s.

The sensitiveness extends from the orange to the violet.

Panchromatic Sensitisers (Hübl).

Pinaverdol (1:500)	3 ozs.	30 c.c.s.
Ethyl violet (1:500)	½ oz.	5 c.c.s.
Collodion emulsion	100 ozs.	1,000 c.c.s.

Pinacyanol can be substituted for ethyl violet.

FOR RED SENSITISING.

Pinacyanol (1 : 1,000)	3 ozs.	3 c.c.s.
Collodion emulsion	100 ozs.	100 c.c.s.

FOR BLUE AND (SLIGHTLY) BLUE-GREEN SENSITIVENESS.

The following sensitiser increases the sensitiveness of the collodion for ordinary work :—

Canary II. (sat. sol.) (Reade Holliday, Huddersfield) ..	1 oz.	10 c.c.s.
Emulsion	10 ozs.	100 c.c.s.

The dyed emulsion keeps well, and in half-tone work gives a sharp, clean dot, but its speed is not improved.

Safe-lights for Developing.

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Or brilliant yellow	0·5 mgm.	$\frac{1}{20}$
Or naphthol yellow	1 mgm.	$\frac{1}{10}$
Or auramine	2 mgm.	$\frac{1}{5}$

Red safe light for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Rose bengal (or fast red) ..	0·5 mgm.	$\frac{1}{20}$

Safe light for Ortho plates.

The above screen is combined with one containing—

Methyl violet	0·5 mgm.	$\frac{1}{20}$

The red screen transmits light from the end of the visible red about λ 7,000 to λ 5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500.

The dyes are dissolved in gelatine solution, which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c.c.s. should be allowed for every 100 sq. cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

DEVELOPERS AND DEVELOPMENT.

In this section we give developers for plates, roll and cut films, arranged in alphabetical order.

Hints on Dissolving Chemicals.

In making up the solutions recollect that those containing the developer do not keep in good condition indefinitely, and that therefore it is well to prepare not more than for, say, three months' use. The alkali, usually the B, solution keeps longer but should be kept in a corked bottle, not one with a glass stopper, which is liable to stick.

Distilled water is not really necessary for making up developers, though it is the best. But it is quite good enough to use ordinary tap or rain water after boiling briskly for 5 minutes and allowing to stand quietly to cool.

In most cases dissolve the sulphite or metabisulphite before adding the pyro or other developer. Metol is an exception : dissolve it first.

Make sure that every bit of the developer is dissolved : metol and amidol are the least soluble developers, and undissolved particles will cause black spots on plates.

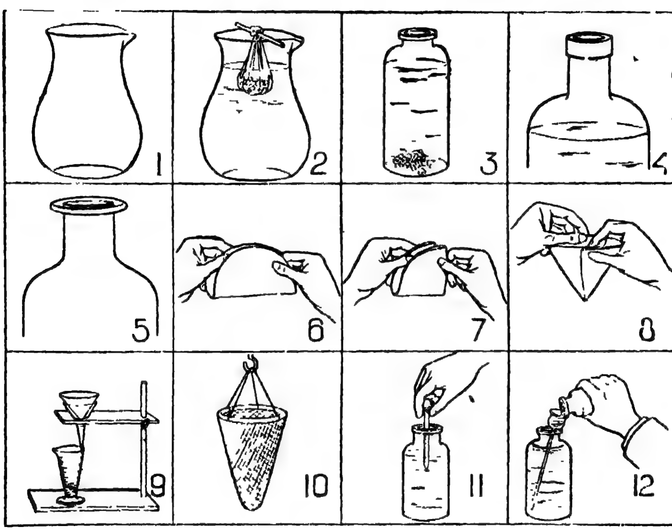
If developer does not make a bright solution it may be worth while to let it stand to clear and then pour off into another bottle, but do not filter, as this oxidises the developer.

When weighing out, never let particles of developer fly about the dark-room to cause black spots on plates or papers.

When making single-solution developers, dissolve the alkali (soda carbonate or caustic soda) separately in, say, one quarter of the water and the other chemicals in three-quarters, to which then add the alkali solution.

For dissolving in hot water a most convenient vessel is a thin beaker-flask (Fig. 1). It will stand boiling water, poured into it or brought to a boil by standing flask over gas or spirit flame with a wire gauze in between.

To dissolve chemicals with least labour, suspend in muslin or



calico bag at top of liquid (Fig. 2); solution falls as it is formed, and fresh water constantly comes in contact with the crystals or powder.

If these latter are at the bottom (Fig. 3) the heavy solution collects round them and requires constantly stirring to remove it.

A bottle with a flat rim of shape shown in Fig 4 pours badly as a rule; the liquid dribbles down the outside.

Fig. 5, on the other hand, is the kind of bottle neck which pours well.

Filtering a solution consists in passing it through a porous paper, held for convenience in a glass funnel.

The circular filter is folded once (Fig. 6),

Then again (Fig. 7), taking care not to run crease right down to the point as this may break paper,

And then opened out into a cone (Fig. 8).

The funnel is placed in the neck of a bottle, inserting a strip of card so as to form a vent for the air, or supported on a filter stand (Fig. 9).

For filtering solutions in bulk, use a flannel or calico bag (Fig. 10).

For measuring minims, a tube with a small rubber bulb (Fig. 11) is more convenient than a measure. With bulb pressed, dip into liquid. Release pressure, and so draw liquid into tube. Again press to deliver any required quantity.

In making up stock single-solution developer it is a good plan to add alkali solution last, pouring it slowly down a "thistle funnel" (Fig. 12) to form a layer at the bottom. Then cork tightly and shake up.

PROPERTIES OF CHEMICALS IN COMMON USE.

Soda sulphite should be in clear crystals. It should be kept well corked, otherwise the crystals become dull and powdery. Such sulphite must be rinsed for a few seconds, in a measure, with enough cold water to cover it, the water poured away and the crystals dried on a clean cloth and weighed out. Warm water, not hot or cold, is the best to use. The ordinary form of sulphite (to be used in all formulæ in this book unless otherwise directed) is the "cryst." The "anhydrous" is a stronger variety, 1 part of which is equivalent to about 2 parts of "cryst."

Potass. metabisulphite should be in flattish crystals, with only a little powdery coating on them. Both dry and in solution it keeps

much better than sulphite, and goes much further as a preservative, yet should be well corked.

It must not be dissolved in hot water. Metabisulphite is an acid substance, every grain neutralising 1 grain of soda carbonate cryst., ½ grain of caustic potash, ⅓ grain caustic soda, or $\frac{3}{10}$ grain dry potass. carbonate.

Soda carbonate, cryst., is best purchased from a photographic dealer: washing soda ("sal soda" in the U S.) is a more or less impure form. The salt loses water in the air, becoming thereby somewhat stronger, and should therefore be kept well corked.

Potass. carbonate should be purchased "dry" and be most securely corked; it absorbs moisture greedily, and if it has been kept for any time should be dried in the oven before weighing out.

Caustic potash.—Purchase as "best stick pure" and keep well corked. Weigh out quickly and handle as little as possible, as it corrodes the skin.

Caustic soda resembles caustic potash, and the same remarks apply.

Note.—In all formulæ the metric weights are not equivalents of the British item for item, but each formula gives a solution of the same composition.

The following are a few of the typical formulæ generally employed for development, etc. :—

Adurol.

TWO-SOLUTION.

A.—Adurol	.. ..	85 grs.	19·5 gms.
Sodium sulphite	.. .. ..	1¾ ozs.	175 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.
B.—Potass. carbonate	.. .. ..	1¼ ozs.	125 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

Adurol resembles hydroquinone as regards giving contrast quickly, but is not so affected by low temperature as hydroquinone.

For studio work and snapshots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

ONE-SOLUTION (CONCENTRATED).

Sodium sulphite	4 ozs.	400 gms.
Potass. carbonate	3 ozs.	300 gms.
Water	10 ozs.	1,000 c.c.s

When all are dissolved add :—

Adurol	½ oz.	50 gms.

For studio work and snap-shots take 1 part with 3 parts of water.
For time exposures outdoor take 1 part with 5 parts of water.

Amidol.

(*Diamidophenol.*)

A normal developer consists of :—

Amidol	2—3 grs.	4 5—7 gms.
Sodium sulphite	25 grs.	57·5 gms.
Water to	1 oz.	1,000 c.c.s.

The mixed developer will keep well in solution for about a week, or sometimes longer, if it is made *not stronger* than given above. It must be made up with freshly dissolved sulphite, as this salt does not keep well in solution for more than a few weeks. A sodium sulphite solution that has had added to it some potassium metabisulphite will, however, keep well for a very long period, and by the addition of dry amidol a fresh developer can be rapidly prepared when required. Make the following stock neutralised sulphite solution :—

NEUTRAL STOCK SULPHITE.

Sodium sulphite	4 ozs.	200 gms.
Potassium metabisulphite ..	½ oz.	25 gms.
Water to	20 ozs.	1,000 c.c.s.

It is *best* to boil this mixture after having dissolved the chemicals in moderately hot water. Boiling is not essential, but it improves the keeping qualities of the solution.

DEVELOPER.

Amidol	40—60 grs.	2—3 grs.	4·5—7 gms.
Stock sulphite sol.	4 ozs.	100 minims	200 c.c.s.
Water to	20 ozs.	1 oz.	1,000 c.c.s.

Amidol is an excellent non-staining developer, giving detail at first nd density afterwards. Suitable for plates, papers and lantern-lides.

Azol.

The following are the instructions for the use of this single-solution developer :—

For Plates and Films:—

Normal exposures:	Azol	20 mins.	¼ oz.
	Water.. ..	to 1 oz.	to 6 ozs.
Under-exposures:	Azol	15 mins.	¼ oz.
	Water.. ..	to 1 oz.	to 8 ozs.
Over-exposures:	Azol	30 mins.	¼ oz.
	Water.. ..	to 1 oz.	to 4 ozs.

For stand development:—Azol, 1 oz.; water, 100 ozs.

For tank development:—Azol, ¾ oz.; water, 40 ozs. Time of development of films at 60 deg. F., 20 to 30 minutes. This solution may be used several times in succession.

For lantern slides and transparencies:—Azol, 25 mins.; potass. bromide 10%, 5 mins., water to 1 oz.

For bromide papers:—Azol, 15 mins.; water to 1 oz. A few drops of 10% solution potass. bromide may be added if the whites are grey.

For gaslight papers:—Azol, 40 mins.: water to 1 oz. Add a few drops of 10% solution of potass. bromide, sufficient to keep the whites clear.

Diamidophenol.

See Amidol.

Edinol.

ONE-SOLUTION.

For soft portrait negatives.

Sodium sulphite	5 ozs.	250 gms.
Edinol	100 grs.	11 gms.
Sodium carbonate..	2 ozs.	100 gms.
Water	20 ozs.	1,000 c.c.s.

For contrasty negatives.

Acetone sulphite (Bayer)	..	288 grs.	33 gms.
Sodium sulphite ..	.. ..	4 ozs.	200 gms.
Edinol	.. ..	100 grs.	11 gms.
Potassium carbonate	.. ..	2 ozs.	100 gms.
Potassium bromide	.. ..	50 grs.	5·5 gms.
Water	.. ..	20 ozs.	1,000 c.c.s

The ingredients should be dissolved strictly in the order given.

Edinol tends to contrast when a carbonate is used: to softness when a caustic alkali is employed. A developer of the latter class contains, in one ounce, edinol, 2½ grs.; caustic soda, 1½ gr.; and sodium sulphite, 10 grs.

Eikonogen.

A.—Sodium sulphite ..	.. ..	2 ozs.	100 gms.
Eikonogen ..	.. .. ..	½ oz.	25 gms.
Distilled water	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. carbonate ..	.. ..	1½ oz.	75 gms.
Distilled water	.. .. ..	20 ozs.	1,000 c.c.s.

For use, mix equal volumes of A. and B.

One-Solution.

Sodium sulphite ..	.. ..	2 ozs.	100 gms.
Sodium carbonate	.. ..	1 oz.	50 gms.
Distilled water	.. .. ..	20 ozs.	1,000 c.c.s.
Eikonogen ..	.. .. ..	½ oz.	25 gms.

Eikonogen is a good developer for full detail without excessive density in the high-lights.

Eikonogen-Hydroquinone.

A.—Hydroquinone	.. .. ..	40 grs.	4·5 gms.
Eikonogen ..	.. .. ..	120 grs.	14 gms.
Sodium sulphite ..	.. ..	480 grs.	55 gms.
Citric acid ..	.. .. ..	20 grs.	2·3 gms.
Water to ..	.. .. ..	20 ozs.	1,000 c.c.s.

B.—Potass. bromide	.. .. ..	5 grs.	0 5 gms.
Sodium carbonate	.. .. ..	60 grs.	7 gms.
Caustic potash	.. .. ..	30 grs.	3 5 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.

For use, mix in equal parts.

This developer is suitable for negatives, lantern plates, and bromide papers.

Ferrous Oxalate.

This developer is rarely used now: it calls for greater exposure of the plate. But it is unique in the perfectly clear grey stainless negatives which it yields.

A.—Potass. oxalate (neutral), 5 ozs ; hot water, 20 ozs. Cool, and pour off clear liquid for use.

B.—Warm water, 20 ozs.; sulphuric acid, 30 minims; sulphate of iron, 5 ozs.

Mix 1 oz. of B. with 3 to 4 ozs. of A (pouring B into A, not *vice versâ*).

A more powerful developer is made by dissolving commercial dry ferrous oxalate in boiling saturated solution of potassium oxalate. As much as will dissolve is stirred in, and the whole left to cool, after which the clear solution is poured off for use.

FOR TRANSPARENCIES ON GELATINO-CHLORIDE PLATES.

A.—Neutral oxalate of potash	..	2 ozs.	100 gms.
Ammonium chloride	.. ..	40 grs.	4·5 gms.
Distilled water	.. .. ..	20 ozs.	1,000 c.c.s
B.—Sulphate of iron	.. .. ..	4 drs.	34 gms.
Citric acid	.. ..	2 drs.	17 gms.
Alum	.. ..	2 drs.	17 gms.
Distilled water	.. .. ..	16 ozs.	1,000 c.c.s

For black tones, mix the above in equal volume.

HURTER AND DRIFFIELD'S STANDARD FERROUS OXALATE DEVELOPER.

(*The Photographic Journal*, 1898.)

A.—Potassium oxalate	.. ..	1 part
Water	.. ..	4 parts

B.—Ferrous sulphate	.. ..	1 part
Citric acid	.. ..	0·01 part
Water	.. ..	3 parts
C.—Potass. bromide	.. ..	1 part
Water	.. ..	100 parts

For use take A, 100 parts; B, 25 parts; C, 10 parts. Development to be conducted at a temperature of 65 deg. F.

The ferrous oxalate as compounded above contains in every 1,000 parts:—Potassium oxalate, 185 parts; ferrous sulphate, 68·5 parts; citric acid, 0·61 part; potassium bromide, 0·74 part.

Glycin.

One-Solution (Hübl).

Boiling water	4 ozs.	1,000 c.c.s.
Sodium sulphite	$2\frac{1}{2}$ ozs.	625 gms.
When dissolved add—		
Glycin	1 oz.	250 gms.
And then in small quantities—		
Potass. carbonate	5 ozs.	1,250 gms.

This forms a thick cream, which must be well shaken and then diluted with water; for normal work, dilute 1 oz. with 12 or 15 ozs. of water; for very soft results with 30 ozs. of water.

One-Solution.

Glycin	1 oz.	33 gms.
Sodium sulphite	$2\frac{1}{2}$ ozs.	83 gms.
Potass. carbonate	5 ozs.	166 gms.
Water to	30 ozs.	1,000 c.c.s.

For normal exposures dilute with an equal bulk of water.

Glycin is a slow-acting developer which keeps for a very long time and yields negatives perfectly free from stain. It is the best reagent for "Stand Development" (which see).

Hydroquinone.

Made up with soda carbonate (as per the first formula below) hydroquinone is a rather slow-acting developer. The caustic-soda formula is quicker, but easily gives excessive density and contrast; it is best suited for line drawings or subjects where full contrast is required.

ONE-SOLUTION.

Hydroquinone	100 grs.	11·5 gms.
Sodium sulphite	$1\frac{1}{2}$ oz.	75 gms.
Sodium carbonate	3 ozs.	150 gms.
Water to..	20 ozs.	1,000 c.c.s.

May be diluted with an equal volume of water.

This formula is not so quick in action as the next one, but there is less tendency for the great density in the high-lights which is easily produced in cases of under-exposure. In all cases the temperature of the hydroquinone developer should not be allowed to fall below 60 deg., or the solution becomes inert.

TWO-SOLUTION (CAUSTIC SODA).

A.—Hydroquinone	160 grs.	18 gms.
Sodium sulphite	2 ozs.	100 gms.
Citric acid	60 grs.	7 gms.
Potass. bromide	40 grs.	4·5 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Caustic soda (stick)	160 grs.	18 gms.
Water to	20 ozs.	1,000 c.c.s.

For use:—A, 1 oz.; B, 1 oz.; water, 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	130 grs.	15 gms.
Sodium sulphite	6 ozs.	300 gms.
Formaline	3 drs.	20 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

A slow developer, giving great clearness in the shadows and plenty of density in high-lights, and specially suitable for line-subjects.

Imogen Sulphite.

A.—Imogen sulphite	1 oz.	83 gms.
Distilled water (warm)	12 ozs.	1,000 c.c.s.
B.—Sodium carbonate	1 oz.	500 gms.
Water	2 ozs.	1,000 c.c.s.

For correct exposure, A, 2 ozs.; B, 2 ozs.; water, 4 ozs. For under-exposure or soft negatives, A, 1 oz.; B, 3 ozs.; water, 4 ozs. For over-exposure, A, 2 ozs.; B, 2 ozs.; water, 3 ozs.; potassium bromide, 40 per cent. solution, 1 oz.

Kachin.

A.—Kachin	160 grs. (Avoirdupois)	9 gms.
Sodium sulphite	$2\frac{1}{2}$ ozs.	62·5 gms.
Water to	20 ozs. (fl.)	500 c.c.s.
B.—Sodium carbonate	2 ozs.	50 gms.
Water to	20 ozs. (fl.)	500 c.c.s.

For use take equal parts of A and B. More diluted developer gives softer results. The solutions should be used at a temperature of 60 to 65 deg. F. Assuming exposure to have been correct, with this solution the image commences to appear in about one minute, and when full density is required development is completed in from four to six minutes. Softer effects are obtained in from three to four minutes. No restrainer is really necessary, but in the case of over-exposure the use of a few drops of 5 per cent. solution of ordinary borax is recommended.

Kachin is almost free from staining properties, and is excellent in its clean development of stale plates, on which it does not produce the common iridescent markings.

Metol.

ONE-SOLUTION (HAUFF).

Metol	150 grs.	17 gms.
Sodium sulphite	2½ ozs.	125 gms.
Sodium carbonate	3½ ozs.	175 gms.
Potass. bromide	16 grs.	1·8 gms.
Water	20 ozs.	1,000 c.c.s.

In making up all metol developers, dissolve the metol first, then the sulphite, and then the other chemicals, using warm but not hot water.

For portraits, take stock solution, 1 oz.; water, 1 oz. For land scapes, stock solution, 1 oz.; water, 2 ozs.

Metol gives delicate negative with great detail and little density unless development is greatly prolonged. See "Factorial Development."

TWO-SOLUTION (HAUFF).

A.—Metol	150 grs.	17 gms.
Sodium sulphite	2½ ozs.	125 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	3½ ozs.	175 gms.
Potass. bromide	16 grs.	2 gms.
Water	20 ozs.	1,000 c.c.s.

For portraits, A, 1 oz.; B, 1 oz. For landscapes, A, 1 oz.; B, 1 oz. water, 1 oz.

ONE-SOLUTION (ANDRESEN).

Metol	160 grs.	18 gms.
Sodium sulphite	3½ ozs.	175 gms.
Potass. carbonate	1¾ oz.	87·5 gms.
Potass. bromide	22 grs.	2·5 gms
Water	20 ozs.	1,000 c.c.s.

For use, take 1 part of developer to 3 of water.

TWO-SOLUTION (ANDRESEN).

A.—Metol	160 grs.	18 gms.
Sodium sulphite	3½ ozs.	175 gms.
Water	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	3½ ozs.	175 gms.
Water	60 ozs.	3,000 c.c.s.

One part of A is mixed with 3 parts of B, potass. bromide being added as required for prevention of fogging.

Metol (and other developers) has a poisoning effect on the skin of many persons, causing painful sores and irritation.

The following ointment has a very beneficial effect in such cases :—

Ichthyol	10 grs.
Lanoline	40 grs.
Boric acid	40 grs.
Vaseline	30 grs.

Apply two or three times a day, and rub in well before retiring for the night.

Metol-Hydroquinone.

ONE-SOLUTION.

Metol	35 grs.	4 gms.
Sodium sulphite	2 ozs.	100 gms.
Hydroquinone	50 grs.	5·7 gms.
Sodium carbonate	$1\frac{1}{2}$ oz.	75 gms.
Water to	20 ozs.	1,000 c.c.s.

This is mixed with an equal volume of water at the time of use.

Dissolve the chemicals in metol-hydroquinone developers, in the order given in the formulæ.

TWO-SOLUTION.

A.—Metol	40 grs.	4·5 gms.
Sodium sulphite	120 grs.	14 gms.
Hydroquinone	50 grs.	5·7 gms.
Potass. bromide	15 grs.	1·7 gm.
Water to	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	$\frac{1}{2}$ oz.	25 gms.
Water	20 ozs.	1,000 c.c.s.

Mix in equal parts.

In cold weather it is best to increase the quantity of metol to, say, 60 grs. (6·8 gms.) and reduce the hydroquinone to, say, 30 grs. (3·4 gms.).

Ortol.

ORTOL-SODA.

A.—Ortol	140 grs.	16 gms.
Potass. metabisulphite .. .	70 grs.	8 gms.
Water, cold	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	$2\frac{1}{4}$ ozs.	125 gms.
Sodium sulphite	$3\frac{1}{2}$ ozs.	175 gms.
Potass. bromide	10 to 20 grs.	1·1 to 2·3 gms.
Water	20 ozs.	1,000 c.c.s.

100 minims of 1 in 2 hypo solution may be added to solution A, and is said to brighten the shadows, but this addition is of doubtful value.

In cold weather the potassium bromide may be left out.

For quick development take 1 part of A and 1 part of B. For slow and soft development take 1 part of A, 1 part of B, and 1 part water.

Ortol solution should not be made up with sodium sulphite, otherwise red stain may be caused, nor should ammonia be used with it. In other respects it closely resembles pyro.

Paramidophenol.

ONE-SOLUTION.

Potassium metabisulphite ..	6 ozs.	300 gms.
Distilled water (boiling)	20 ozs.	1,000 c.c.s.
Paramidophenol	2 ozs.	100 gms.

Dissolve in the above order and add gradually—

Caustic soda or potash	q.s.

to dissolve the precipitate first formed.

For use, dilute 1 oz. with from 10–30 ounces of water.

Paramidophenol is stainless and keeps well in single solution, owing probably to its preservative action on soda sulphite.

TWO-SOLUTION.

A.—Paramidophenol hydrochloride ..	200 grs.	23 gms.
Potassium metabisulphite ..	100 grs.	11·5 gms.
Distilled water to..	20 ozs.	1,000 c.c.s.
B.—Sodium sulphite	1¼ oz.	62·5 gms.
Potassium carbonate	1¼ oz.	62·5 gms.
Distilled water to..	20 ozs.	1,000 c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

Pyro-Acetone.

A.—Pyro..	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 gms.
Distilled water to..	9 ozs.	1,000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised, and there should be no addition of citric acid.

A normal developer consists of :—

A. sol (= pyro, 4 grs. or 8 gms.)	40 minims	80 c.c.s.
Acetone	40 minims	80 c.c.s.
Water	1 oz.	1,000 c.c.s.

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

Pyro-Ammonia.

(10% SOLUTIONS.)

A.—Pyro	1 oz.	100 gms.
Potass. metabisulphite*	1 oz.	100 gms.
Water to make	9 ozs.	1,000 c.c.s.
B.—Potass. bromide	1 oz.	100 gms.
Distilled water to	9 ozs.	1,000 c.c.s.
C.—Liquid ammonia (0·880).. ..	1 oz. (fl.)	100 c.c.s.
Distilled water to..	9 ozs.	1,000 c.c.s.

*Or Soda sulphite .. .. .. 4 ozs. 400 gms.

To make a normal developer, take A, 20 minims; B, 10 minims; C, 30 minims; water to 1 oz.; or if no bromide is used, A, 20 minims; C, 10 minims; to water, 1 oz.; or in metric measures, A, 2 c.c.s.; B, 1 c.c.; C, 3 c.c.s.; water to 50 c.c.s.

Pyro-Soda Developer.

(The "B.J." Formula.)

Make up two solutions according to the following formulæ—

A.—Neutral sulphite solution	..	14 ozs.	700 c.c.s.
Pyro (sublimed or cryst.)	..	160 grs.	18 gms.
Water to make	..	20 ozs.	1,000 c.c.s.
B.—Soda carbonate	..	4 ozs.	200 gms.
Water to make	..	20 ozs.	1,000 c.c.s.

Take A, 1 part: B, 1 part: water, 2 parts.

The following is the neutral sulphite solution—

Soda sulphite cryst. ..	..	4 ozs.	200 gms.
Potass. metabisulphite ..	..	½ oz.	25 gms.
Water to	..	20 ozs.	1,000 c.c.s.

This solution should be boiled if possible as the keeping quality of the solution is thereby improved.

This developer will produce negatives free from pyro stain, and 4 to 6 minutes' development at normal temperature with full exposure will yield soft negatives full of detail and well suited to enlarging. The advantages of the developer are its cleanliness and the extraordinary keeping qualities of the A solution.

When stronger negatives are required, the developer can be made up by taking equal parts of A, of B, and of water, or equal parts of A and B alone can be used, this giving a developer containing 4 grains pyro to the ounce.

The mixed solution can be used for several plates in succession if a little extra time is given for development in each case.

It will be noticed that in making up A solution 14 parts of sulphite solution must be added to 6 parts of water, which is equivalent to adding 7 parts to 3. If less sulphite solution is taken, a slightly quicker developer is obtained, but the result will show pyro stain in the lights.

It is as well to use freshly made neutral sulphite solution for making up the A solution if absolute freedom from stain is desired.

The Hurter and Driffield standard pyro-soda developer for plate-speed testing is:—

Pyro	.. ..	8 parts.
Sodium carbonate	.. ..	40 parts.
Sodium sulphite ..	.. ..	40 parts.
Water to	.. ..	1,000 parts.

Pyro-Caustic Soda.

(VALENTA.)

A.—Pyro	220 grs.	25 gms.
Soda sulphite	3¼ ozs.	162·5 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Caustic potash	100 grs.	11·5 gms.
or		
Caustic soda	70 grs.	8·5 gms.
Water to	20 ozs.	1,000 c.c.s.

Take A, 1 oz.; B, 1 oz.; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

Pyro-Metol.

A.—Pyro	80 grs.	9·2 gms.
Metol	70 grs.	8 gms.
Potass. metabisulphite	180 grs.	20 gms.
Potass. bromide	30 grs.	3·5 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Soda carbonate	3 ozs.	150 gms.
Water to	20 ozs.	1,000 c.c.s.

For normal exposures, use equal parts. For under-exposures, increase the proportion of B and add water.

Pyro-metol is a developer which gives both detail and density quickly. The negatives are of slightly greenish-black colour, of good printing quality. An excellent developer for hand-camera exposures.

Pyrocatechin.

TWO-SOLUTION.

A.—Pyrocatechin	175 grs.	20 gms.
Sodium sulphite	1½ oz.	75 gms.
Water	20 ozs.	1,000 c.c.s
B.—Potass. carbonate	2½ ozs.	125 gms.
Water	20 ozs.	1,000 c.c.s

Equal parts are mixed together.

ONE-SOLUTION.

Sodium sulphite	5 ozs.	250 gms.
Water	20 ozs.	1,000 c.c.s.
Caustic soda	260 to 300 grs.	30 to 34·5 gms.
Pyrocatechin	400 grs.	46 gms.

The chemicals are dissolved in this order, and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

Rodinal.

Rodinal is a concentrated liquid preparation of para-amido-phenol.

For general work, development of negatives:—Rodinal, 1 oz.; water, 25 ozs. A stronger solution, *e.g.* Rodinal, 1 oz.; water, 10 oz.; can be used to give density in a shorter time.

For over-exposures it is convenient to keep the following stock solution :—

Rodinal	1 oz.	30 c.c.s.
Potass. bromide	150 grs.	10 gms.
Water	1 oz.	30 c.c.s.

And add a few drops to the 1 : 30 rodinal developer in cases of over-exposure.

For under-exposures :—Rodinal, 1 oz. : water, 30, 40, or 80 ozs.

Stand Development.

Glycin is a very suitable developer for this purpose, and the following directions are given by Hübl for the use of the formula (given on another page) for a concentrated solution.

Normal developer :—Stock sol., 1 oz. ; water, 80 to 90 ozs.; potass. bromide, 10 per cent. sol., 80 minims.

In this solution a properly exposed plate should make its appearance in 15 or 20 minutes, and obtain full density in several hours.

For under-exposures :—Stock sol., 1 oz. ; caustic soda sol. (10%), 1 oz. ; water, 50 oz., warmed to 75 deg. F.

For over-exposures :—Stock sol., 1 oz. ; potass. bromide, 10% sol. 1 oz. ; water, 25 ozs.

Factorial Development.

The total time of development (found by trial to give a certain amount of contrast) divided by the time in which the image first appears is the "factor" of a developer.

The following "Watkins' factors" are abstracted from the instructions from the "Watkins' dark room clock and factorial calculator" :—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Factor.		Grs. pyro to oz.	Grs. brom. to oz.	Factor.
Pyro-soda without bromide	1	18	Pyro-soda with bromide	1	¼	9
	2	12		2	½	5
	3	10		3	¾	4½
	4	8		4	1	4
	5	6½		8	2	3½

Pyro-acetone—about double the above figures.

	Factor.
Adurol (Schering or Hauff)	5
Amidol (2 grs. per oz) ..	18
Diamidophenol	60
Diogen	12
Edinol	20
Eikonogen	9
Glycin (carb. soda.) ..	8
Glycin (carb. potass.) ..	12
Hydroquinone (min. B) ..	5
Hydroquinone (max. B) ..	4½
Ilford pyro-soda (maximum pyro)	4½
Ilford pyro-soda (minimum pyro)	5½
Imogen sulphite	6
Imperial pyro-soda ..	4¾
Imperial Standard (pyro-metol)	9
Kachin	10
Kodak powders	18
Metol	30
Metol-hydroquinone ..	14
Ortol	10
Pyrocatechin	10
Quinomet	30
Rodinal	40

Note.—High-factor developers (*e.g.*, metol and rodinal), owing to the long time which is needed for density, tend to softness. Short-factor developers (*e.g.*, hydroquinone and strong pyro-soda) tend to hardness, as they quickly build up density after the image appears.

Where a factor divides evenly into 60, the product is called a divisor, and will greatly facilitate calculating the total time of development. Thus adurol has a divisor of 12 (60 divided by 5), and if the time of appearance in *seconds* is divided by 12 the result is the number of *minutes* to develop.

PYRO-SODA DEVELOPERS.

With and without bromide.

	Factor.		Factor
Austin-Edwards (with B) ..	5	Marion (with B)	4½
Barnet (with B)	4¾	Mawson (no B)	10
Cadett (no B)	9	Paget (no B)..	11
Kodak (no B)	12	Thomas (with B)	5
Edwards (with B)	4½	Wratten (no B)	11
Premier (with B)	4½	Wellington (normal) ..	11
Gem (with B)	4	Wellington (studio) ..	15

Combined Development and Fixing.

Although there is not much to be said for simultaneous development and fixing on practical grounds, the following formula may be given as one of the best for the purpose :—

A.—Kachin	150 grs.	17 gms.
Sodium sulphite	3 ozs.	150 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Caustic soda	160 grs.	18 gms.
Water to	20 ozs.	1,000 c.c.s.
C.—Hypo	1 oz.	560 gms.
Water to	2 ozs.	1,000 c.c.s.

Take :—A, 160 minims ; B, 24 minims ; C, 20 minims ; water to 1 oz. or, A, 32 c.c.s. ; B, 5 c.c.s. ; C, 4 c.c.s. ; water to 100c.c.s.

Restrainers.

Potassium bromide in 10 per cent. solution is the most common restrainer. The dose is from one half-grain (5 minims) per ounce of developer.

Ammonium citrate solution has the advantage that after it has been added to the developer density can be obtained without further fogging, though the development of detail is prevented. An average dose with the pyro-ammonia developer is 6 to 10 grains per ounce (60 to 100 minims of solution made by adding ammonia, about 250 minims, to 1 ounce of citric acid dissolved in a little water until neutral, and diluting the whole to 10 ounces).

Potassium borotartrate.—10 to 30 minims of a 10 per cent. solution restrain with most developers.

Sodium bicarbonate acts as a restrainer, particularly with amidol developer.

FIXING, & HYPO ELIMINATORS.

The Hypo Fixing Bath.

In making up the fixing bath cold water should not be used: the hypo greatly chills the water as it dissolves, and hinders the process. There is no harm in using even very hot water if the bath is cold before use.

The average strength of hypo for fixing negatives is 4 ozs. per 20 ozs. It should not be less, but may be more—5, 6 or 8 ozs.

A convenient method of keeping hypo is: dissolve each pound in about a pint of water (hot), cool and make up to 32 ozs. in all. Every 2 ozs. of this stock solution equals 1 oz. hypo. It is used as follows to make up baths of various strength:—

Hypo, required per 20 ozs. of fixing bath.		Mix, of stock solution,		Water.	
8 ozs.	..	16	with	4	*i.e.*, stock, 4; water, 1.
6 ozs.	..	12	with	8	*i.e.*, stock, 3; water, 2.
5 ozs.	..	10	with	10	*i.e.*, equal parts.
4 ozs.	..	8	with	12	*i.e.*, stock, 2; water, 3.
3 ozs.	..	6	with	14	*i.e.*, stock, 3; water, 7.
2 ozs.	..	4	with	16	*i.e.*, stock, 1; water, 4.

In fixing plates, observe three golden rules:—

1.—Let plates remain in fixer as long again as it takes for the white emulsion to dissolve away.

2.—Always rinse fingers under tap or in a dish of water after touching hypo, not simply wipe on a towel.

3.—Avoid letting hypo droppings dry up on table or floor. If hypo solution drops or is splashed or spilt about the dark room, mop it up with a floor cloth and leave all clean.

Acid Fixing Baths.

Hypo	..	4 to 6 ozs.	200 to 300 gms.
Potass. metabisulphite	..	½ oz.	25 gms.
Water	..	20 ozs.	1,000 c.c.s.

The metabisulphite should be added only when the hypo solution is cool or tepid—not when it is hot.

This is the best formula we know for an acid fixing bath for plates or papers. It keeps clear and stainless to the last, and does not throw down sulphur with use.

The following is a cheaper bath:—

Hypo solution (1 : 5)	..	50 ozs.	1,000 c.c.s.

To which add a mixture of—

Tartaric acid solution (1 : 2)	..	1½ oz.	30 c.c.s.
Sodium sulphite solution (1 : 4)		3½ ozs.	70 c.c.s.

Alum-Hypo Fixing Bath.

Alum (saturated solution)	20 ozs.	1,000 c.c.s.
Sodium sulphite (saturated solution)	4—7 ozs.	200-300 c.c.s.
Hypo-solution (1:5) ..	20—28 ozs.	1,000-1,250 c.c.s.

Chrome Alum and Hypo Fixing Bath.

Add—

Strong sulphuric acid	2 dr. (fl.)	10 c.c.s.
Water	2 ozs.	80 c.c.s.

to—

Sodium sulphite	2 ozs.	80 gms.
Water	6 ozs.	240 c.c.s.

And pour the mixture into—

Hypo	16 ozs.	700 gms.
Water	48 ozs.	2,000 c.c.s

Finally add to the above mixture—

Chrome alum	1 oz.	40 gms.
Water	8 ozs.	300 c.c.s.

Removing Hypo by Washing.

In washing negatives in running water or frequent changes, over 90 per cent. of the hypo is cleared away in less than ten minutes. To remove the remainder, by a washer or hand method, it is essential to drain off *all* the water in which the negative has soaked. The best washers are those which alternately empty and refill, and the same principle should be followed when washing in dishes. If this is done, there is no need to wash negatives longer than an hour at the outside.

Hypo-eliminators are chemicals which convert the hypo into some other substance, but as it is not certain into what, this chemical method of removing hypo is not so reliable as removal by washing. But we give three formulæ.

Hypo-Eliminators.

Permanganate.

Wash the negative for one minute under the tap, and transfer to a shallow dish containing water with enough potass. permanganate in it to turn it pink. Remove the negative as soon as the colour goes (which will be in a second or two if hypo is present), and keep on treating in the very weak permanganate baths until the colour is not discharged. The water itself will destroy the permanganate colour, but not quickly as hypo does. A very cheap and satisfactory process which allows of a negative being ready for drying within three minutes of fixation.

Persulphate.

Ammonium persulphate	2½ grs.	6 gms.
Carbonate of soda..	5 grs.	12 gms.
Water	1 oz.	1,000 c.c.s.

PERCARBONATE.

Potassium percarbonate	$2\frac{1}{2}$ grs.	6 gms.
Water	1 oz.	1,000 c.c.s.

Rapid Drying of Negatives.

Method I.—Rinse from the hypo-bath, place in 1:50 formaline for ten minutes, wash by pouring nearly boiling water six times over the negative and dry by heat. To get rid of the relief which is produced by this process the negative is rubbed with a piece of wash-leather moistened with alcohol.

Method II.—After washing in the usual way or using a hypo-eliminator, lay a piece of old fine cambric on the negative and firmly pass a roller squeegee over it. The negative, with much of the water thus removed, will dry in a few minutes in a moderately warm place.

Method III.—Soak in two successive baths of methylated spirit, and place in a current of air. The present commercial spirit, owing to the mineral naphtha in it, causes a whitish scum on the surface of the film, and is not favourable to clean work.

HARDENING AND CLEARING SOLUTIONS.

As a general rule, there is no need to use a bath of alum; frilling or softening of the films of plates is seldom met with—that is, in temperate latitudes When it does occur, it is most usually the result of baths (developing, fixing, etc.) being of very different strengths or at *different* temperatures.

If a plate *should* show signs of frilling in the developer, it should be rinsed for an instant and placed in one of the hardening baths, given below, then washed for ten minutes before fixing. This is better than hardening *after* fixing.

Hardening Baths.

Formaline	1 oz fluid.	50 c.c.s.
Water	10 to 20 ozs.	500-1,000 c.c.s.
Alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Chrome alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

Whichever bath is used, allow it to act for 15 or 20 minutes.

In making up the chrome alum bath, use cold or warm, not hot, water.

Clearing Solutions.

Acid Alum.

Alum	2 ozs.	200 gms.
Citric acid	1 oz.	100 gms.
Water	10 ozs.	1,000 c.c.s.

Wash well after fixing, and immerse the negative in the above. This bath is also useful for removing white scum from negatives developed with ferrous oxalate if rubbed on with cotton wool.

Chrome Alum.

Chrome alum	½ oz.	25 gms.
Hydrochloric acid..	½ oz.	25 c.c.s.
or		
Citric acid	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

We prefer this latter bath for the final treatment of negatives, and for obtaining a clean smooth film.

Thiocarbamide.

Thiocarbamide	90 grs.	10 gms.
Citric acid	90 grs.	10 gms.
Water	20 ozs.	1,000 c.c.s.

Sodium Hypochlorite.

(*Eau de Javelle.*)

This bath need only be resorted to in cases of severe stain, particularly on old negatives.

Bleaching powder..	1 oz.	30 gms.
Sodium carbonate..	1½ oz.	45 gms.

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s.), and filter. Extract the residue with plain water, and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

Removing Silver Stains.

Most silver stains (due to dampness of paper or negative while the two are in contact) will readily yield to the following simple treatment first suggested by Mr. Harold Baker :—

Rub the dry negative with Globe metal polish (or other similar abrading preparation) for a minute or two. This is done by applying the polishing paste on a tuft of cotton wool. Then place negative in very strong hypo solution. Here the stain disappears: the time may be minutes or hours according to the depth and age of the stain.

In very severe cases the following method may be necessary :—

Soak the negative in—

A.—Potass. iodide	200 grs.	45 gms.
Water	10 ozs.	1,000 c.c.s.

and after washing transfer to—

B.—Potass. cyanide	.. .. ..	300 grs.	70 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment a solution of iodine (in potass. iodide) may be used in place of solution A.

NEGATIVE INTENSIFIERS.

Negatives which are too thin (and as a rule yield flat prints) may be greatly improved by intensification.

If the negative is thin through under-exposure, that is, has not attained good density even on long development, the best intensifier is the uranium. For this, as for most intensifiers, the plate should be both thoroughly fixed and washed—one is as important as the other.

If the plate is simply under-developed—clear and bright, but thin—the chromium or the mercury and ferrous oxalate intensifier (applied more than once if necessary) or the Wellington silver intensifier is very suitable. If the plate is over-exposed, thin but veiled and flat, the mercury and ammonia intensifier is a good remedy; or it may be well first to reduce carefully with Farmer's reducer, and then (after a second thorough wash) to intensify with chromium, mercury and ferrous oxalate, Wellington, or, if plate is very flat, with Monckhoven's or the mercury and ammonia formula. The copper and lead intensifiers give great density, and are suited only for negatives of line drawings, etc., in which great general opacity and, at the same time, great clearness of the lines are required.

Mercury Intensification.

The negative is bleached in the following saturated solution of mercury bichloride:—

Mercury bichloride (corrosive sublimate)	.. .. ..	1 oz.	62 gms.
Hot water	.. .. ..	16 ozs.	1,000 c.c.s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid	.. .. ..	30 minims	4 c.c.s.

After *well washing*, the bleached negative is blackened in one or other of the following:—

A.—Ammonia (0·880)	.. .. ..	20 drops	20 drops
Water	.. ..	1 oz.	30 c.c.s.

Gives great intensification and good black colour.

B.—Soda sulphite, 10 per cent. solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C.—An alkaline developer, such as pyro-soda, pyro-ammonia, hydroquinone. Gives about double the intensification of B.

D.—Schlippe's salt	.. .. ..	200-400 grs.	20-40 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

This solution must be made fresh, and gives great intensification.

E.—Ferrous oxalate developer, made as directed under "Developers." This process can be repeated as many times as desired, and gives absolutely permanent results: it deals evenly throughout with the tones in the negative.

Monckhoven's.

A.—Bromide of potassium	.. ..	10 grs.	23 gms.
Bichloride of mercury	.. ..	10 grs.	23 gms.
Water	.. ..	1 oz.	1,000 c.c.s.
B.—Pure cyanide of potassium	..	10 grs.	23 gms.
Nitrate of silver	.. .. ..	10 grs.	23 gms.
Water	.. ..	1 oz.	1,000 c.c.s.

The silver and cyanide are dissolved in separate lots of water, and the former added to the latter until a permanent precipitate is produced. The mixture is allowed to stand 15 minutes, and, after filtering, forms Solution B.

Place the negative in A till it is white, then rinse and transfer it to Solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

Mercuric Iodide.

Water	.. ..	20 ozs.	1,000 c.c.s.
Sodium sulphite	.. .. ..	4 ozs.	200 gms.
Mercuric iodide	.. .. ..	90 grs.	10 gms

The sulphite must be dissolved first. The solution keeps well in the dark.

This is a very convenient intensifier, as plates need only be rinsed for a few minutes in water on coming out of the hypo bath to be ready for intensification.

When intensified they are simply washed for a few minutes; the negative is then liable to yellow in time, but if plate is placed for a few minutes in any non-staining developer the results are quite permanent.

If mercuric iodide is not available the following may be used:—

Mercuric chloride	.. .. ..	50 grs.	6 gms.
Water	.. ..	10 ozs.	500 c.c.s.

Add 10 per cent. potass. iodide solution until precipitate first

formed is redissolved. About 1½ oz. (75 c.c.s.) will be required, and when clear, add—

Sodium sulphite	4 ozs.	200 gms.
Water to make	20 ozs.	1,000 c.c.s.

Silver Intensifiers.

J. B. B. Wellington's Formula (1911).

First harden the film in :—Formaline, 1 part; water, 10 parts, for five minutes. Rinse for a few minutes, and then place for *exactly one minute* in :—

I.—Potass. ferricyanide	20 grs.	2·3 gms.
Potass. bromide	20 grs.	2·3 gms.
Water	20 ozs.	1,000 c.c.s.

This causes no apparent change in the negative; if used too long it will bleach the negative and alter its gradation. Rinse again for a few minutes and intensify.

Stock Solutions.

A.—Silver nitrate	800 grs.	91·2 gms.
Water, distilled, to	20 ozs.	1,000 c.c.s.
B.—Ammonium sulphocyanide ..	1,400 grs.	160 gms.
Hypo	1,400 grs.	160 gms.
Water to	20 ozs.	1,000 c.c.s.

Take A, ½ oz., and add slowly to ½ oz. B, stirring vigorously (mixture should be clear); then add 10 % pyro solution, (preserved with sulphite), 1 dram, and 10 % ammonia solution, 2 drams.

Place negative in chemically clean dish, best of glass, and pour solution over it. Silver begins to deposit in a minute or two. When intensified enough, place in acid fixer and well wash. Flat negatives may be over-intensified and then treated with Farmer's reducer.

Acid Silver.

A.—Pyro	15 grs.	3·5 gms.
Citric acid	5-10 grs.	1-2 gms.
Water	10 ozs.	1,000 c.c.s.
B.—Silver nitrate	10 grs.	23 gms.
Water to	1 oz.	1,000 c.c.s.

About 1 oz. (30 c.c.s.) of A is poured over the plate once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed. Negatives (on gelatine plates) are best hardened with alum or formaline before using this intensifier, otherwise it is difficult to avoid stains.

Chromium Intensifier.

(C. Welborne Piper.)

An excellent and convenient intensifier for general work Results permanent.

	A.	B.	C.
Potassium bichromate ..	5 grs.	10 grs.	10 grs.
Hydrochloric acid (sp. gr., 1·160)*	1 minim	5 minims	20 minims
Water	1 oz.	1 oz.	1 oz.

Bleach in A, B or C solution, wash until yellow stain is removed, and then develop (by daylight, or after exposure to daylight) with amidol.

A gives intensification about equal to mercury and ammonia; B, to that of mercury and ferrous oxalate; and C, to that of mercury and sodium sulphite.

The process may be safely applied after fixation if the plate is simply rinsed for a minute or so.

It may be repeated several times if the first application does not give enough density.

Copper Intensifier.

Gives great intensification and is best suited for line subjects.

A.—Copper sulphate	100 grs.	230 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. bromide	100 grs.	230 gms.
Water to	1 oz.	1,000 c.c.s.

A and B are separately made up with hot water, mixed, and allowed to cool. The negative is bleached in the mixture, and washed for a minute or two. It is then blackened in :—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1,000 c.c.s.

For still greater density, the negative is well washed from silver, and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass. cyanide (about 2 grs. per oz.).

Lead Intensifier.

Lead nitrate	400 grs.	46 gms.
Potass. ferricyanide	600 grs.	70 gms.
Acetic acid	3 drachms	20 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 per cent. nitric acid—the acid makes the film very tender—then in water, and then darkened in :—

A.—Sodium sulphide	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

* "Commercial pure" strong acid.

Or in—

B.—Schlippe's salt	.. .. ..	90 grs.	10 gms.
Ammonia (0·880)	.. .. ..	6 drachms	40 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

Or in—

C.—Potass. bichromate	.. ..	1 oz.	100 gms.
Ammonia (0·880)	.. .. ..	½ oz.	50 c.c.s.
Water	.. ..	10 ozs.	1,000 c.c.s.

The lead intensifier gives very great intensification, and is suited only for line-subjects.

Uranium Intensifier.

A.—Uranium nitrate	.. .. ..	100 grs.	23 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	100 grs.	23 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

The intensifier is prepared from:—A sol., 1 oz.; B sol., 1 oz.; acetic acid, 2 drachms.

The plate must be perfectly free from hypo, and after intensification be washed in several changes of *still* water until the yellow stain is gone. A 10 gr. per oz. solution of ammonium sulphocyanide removes any yellow stain, and weak ammonia or sodium carbonate removes the intensification altogether, restoring the negative to its original state. A weak acetic acid bath should then be applied to the negative if the intensifier is to be again applied.

NEGATIVE REDUCERS.

Reduction is useful if the negative is so dense (black) that it takes long to print. Also, apart from reducing time of printing, reduction is used to improve the gradation of negatives.

For those which are too hard, usually as the result of under-exposure and too long development, the best reducer is the persulphate. The permanganate and bichromate are similar in their effect.

For those which, though dense, yield prints which are too flat—this is the result of great over-exposure and long development—the best is Farmer's. Belitski's is similar.

Even when density is not excessive, it is usually well, in the case of flat negatives, to reduce a little in "Farmer's," and then intensify.

The other reducers—Eder's, iodine-cyanide, and ceric sulphate—are used chiefly when it is desired to reduce somewhat negatives of good gradation.

Farmer's.

This reducer tends to remove detail in the shadows whilst leaving untouched the dense high-lights. Hence it increases contrast: "brightens up" a negative.

Hypo solution (1 : 5)	5 ozs.	150 c.c.s.
Potass. ferricyanide (10% sol.) ..	quant. suff.	quant. suff.

The colour is a fair indication of the strength of the reducer; it should be pale yellow, not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less.

Yellow stain is due usually to the use of an acid fixing bath, or an old fixing bath, instead of clean plain hypo solution. It is not easy to remove.

If the reduction is required as "even" as possible, that is less pronounced on the shadows of the subject in the negative, use the reducer very weak, viz.: largely diluted with water.

Where the extreme of contrast is required, use a strong reducer, applying it with cotton wool, not too wet with reducer. Very useful for line negatives, where quite clear lines on a dense ground are wanted.

Belitski's.

Potass. ferric oxalate	150 grs.	10 gms.
Sodium sulphite	125 grs.	8 gms.
Water..	7 ozs.	200 c.c.s.

Dissolve and add—

Oxalic acid..	40 to 45 grs.	2·5 to 3·1 gms.

and shake until the solution turns green. Then pour off from undissolved crystals and add—

Hypo	1¾ oz.	50 gms.

Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula:—

Ferric chloride cryst.	100 grs.	6·5 gms.
Potass. oxalate	190 grs.	12·5 gms.

This reducer is stainless, and keeps well in the dark. Its action on the shadow detail of the negative is similar to that of Farmer's.

Persulphate.

Ammonium persulphate.. ..	10 to 20 grs.	23 to 45 gms.
Water	1 oz.	1,000 c.c.s.

A fresh solution is made at time of use. A drop of sulphuric acid per 2 ozs. makes the action more regular. It is best also to use the reducer before the negative has dried.

When sufficiently reduced—indeed, slightly before—the negative is placed at once into 5 per cent. sodium sulphite solution.

If much reduction has taken place it is well to fix a second time. The persulphate reducer acts first on the heavy high-light densities of the negatives, reducing these without affecting shadow detail. It thus "softens" a hard negative.

Eder's (Mercury and Cyanide).

Potassium cyanide	20 grs.	5 gms.
Potassium iodide	10 grs.	2 gms.
Mercury bichloride	10 grs.	2 gms.
Water	10 ozs.	1,000 c.c.s

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, and is non-staining and intensely poisonous.

Iodine-Cyanide.

Iodine (10 per cent. sol. in potass. iodide sol.)	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)..	5 minims	1 c.c.s.
Water	1 oz.	100 c.c.s.

A very clean-acting (but intensely poisonous) reducer. Very suitable, when used quite weak, for bromide prints, as it leaves no stain.

Ceric Sulphate.

Sulphuric acid (sp. gr. 1·98) ..	20 minims	4 c.c.s.
Water	2 ozs.	200 c.c.s.
Dissolve in this—		
Ceric sulphate	2 ozs.	100 gms.
And dilute to—		
Water	10 ozs.	1,000 c.c.s.

Hard negatives are placed wet in a mixture of this stock solution and nine times its volume of water. Reduces contrasts. Over-exposed, long-developed negatives are dipped dry into a mixture of stock solution and an equal part of water and carefully watched as the action is very rapid. A convenient form of the reducer is the stock solution sold by Lumière.

Permanganate.

Potass. permanganate, 10% solution	1 dr.	10 c.c.s.
Sulphuric acid (10% solution by volume of 1·98 acid)	5 drs.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.

Applied to a wet negative gives even reduction. A dry negative receives greater reduction in the high-lights, and great softening may be obtained by immersing dry negative quickly in the reducer, washing immediately, drying and re-immersing. Any brown stains are removed with a 10% solution of sodium sulphite containing 2% oxalic acid.

Bichromate.

Potass. bichromate	100 grs.	20 gms.
Sulphuric acid	7 drs. (fl.)	40 c.c.s.
Water	20 ozs.	1,000 c.c.s.

Hypochlor and Alum.

Chrome alum	10 grs.	4 gms.
Eau de Javelle	½ oz.	100 c.c.s.
(See "Clearing Solutions")		
Water to make	5 ozs.	1,000 c.c.s.

Immerse the negative and gently rub the surface with a piece of cotton wool. By confining friction with the wool to certain parts, extra reduction can be obtained.

Reducing Hard Negatives.

A most valuable and perfectly safe method of reducing excessively hard negatives is one dependent on re-development. Bleach the negative first in a solution of ferricyanide and potassium bromide. using the same bath as is commonly employed for sulphide toning, After a thorough wash re-develop in a developer containing 2 per cent. of rodinal and 1 per cent. of potassium bromide—that is, one containing 1 dram of rodinal and 5 drams of 10 per cent. bromide solution in 6 ozs. of water. Development will be very slow, but the plate may be left to itself for half an hour or so, as the action cannot go too far. When development is sufficient the plate is fixed, washed, and dried.

Baskett's (Local) Reducer.

It consists of—

Globe metal polish	2d. tin
Terebene	2 ozs.
Salad oil	2 ozs.

The ingredients are to be well mixed, and strained through fine muslin two or three times to remove any coarse particles. Dense parts of a negative are rubbed down with the reducer applied by the finger-tip or with a bit of chamois leather.

NEGATIVE VARNISHES.

Hot Varnishes.

No. 1.—	Sandarac..	4 ozs.	113 gms.
	Alcohol	28 ozs.	800 c.c.s.
	Oil of lavender	3 ozs.	85 c.c.s.

This is a good varnish for retouching upon, and a tooth is easily obtained by rubbing.

No. 2.—	Seed lac	2 ozs.	50 gms.
	Sandarac..	2 ozs.	50 gms.
	Oil of lavender	½ oz.	12·5 gms.
	Castor oil	1 oz.	25 c.c.s.
	Alcohol	40 ozs.	1,000 c.c.s.

To prepare a good surface for the retouching pencil, the negative after varnishing is dusted over with fine resin powder and rubbed up with the fingers.

No. 3.—White hard varnish	.. ..	15 ozs.	150 c.c.s.
Rectified spirit (not methylated spirit)	.. ..	20 to 30 ozs.	200 to 300 c.c.s.

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

No. 4.—Bleached shellac	.. ..	1¼ ozs.	62 gms.
Mastic	.. ..	¼ oz.	13 gms.
Oil of turpentine	.. ..	¼ oz.	13 c.c.s.
Sandarac	.. ..	1¼ oz.	62 gms.
Alcohol	.. ..	20 ozs. (fl.)	1,000 c.c.s.

Tough, hard, and durable.

No. 5.—Sandarac	.. ..	80 ozs.	160 gms.
Turpentine	.. .. ..	36 ozs.	72 c.c.s.
Oil of lavender	.. .. ..	10 ozs.	20 c.c.s.
Alcohol	.. ..	500 ozs.	1,000 c.c.s.

This one may also be rubbed down with powdered resin, and gives a splendid surface for retouching.

No. 6.—Sandarac	.. .. ..	1 oz.	55 gms.
Seed lac	.. ..	1½ oz.	83 gms.
Castor oil	.. .. ..	3 drs.	20 c.c.s.
Oil of lavender	.. .. ..	1½ dr.	10 c.c.s.
Alcohol	.. ..	18 ozs. (fl.)	1,000 c.c.s.

This varnish is somewhat dark in colour.

No. 7.—Best orange shellac	.. ..	2½ ozs.	125 gms.
Oil of lavender or oil of turpentine	.. ..	¼ oz.	13 c.c.s.
Methylated alcohol	.. ..	20 ozs.	1,000 c.c.s.

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

Cold Varnishes.

No. 1.—Celluloid	.. ..	1 oz.	10 gms.
Amyl acetate	.. .. ..	50 ozs.	500 c.c.s.

To counteract the sickly odour of amyl acetate, add a small proportion of oil of lavender.

This may be flowed over or applied with a brush to the cold negative.

No, 2.—Zanzibar copal	.. .. ..	6 ozs.	30 gms.
Amber (fused)	.. .. ..	1 oz.	5 gms.
Ether	.. ..	60 ozs.	300 c.c.s.
Acetone	.. ..	40 ozs.	200 c.c.s.
Chloroform	.. .. ..	4 ozs.	20 c.c.s.

No. 3.—20% shellac solution	.. ..	2 ozs.	160 c.c.s.
Ammonia (0·880)	.. ..	3 drs.	30 c.c.s.
Methylated spirit	.. ..	4 ozs.	320 c.c.s.

No. 4.—A mixture of Japanese gold size (1 part) and benzole (2 parts) forms a rather slow-drying though otherwise excellent cold varnish. The surface takes the pencil well.

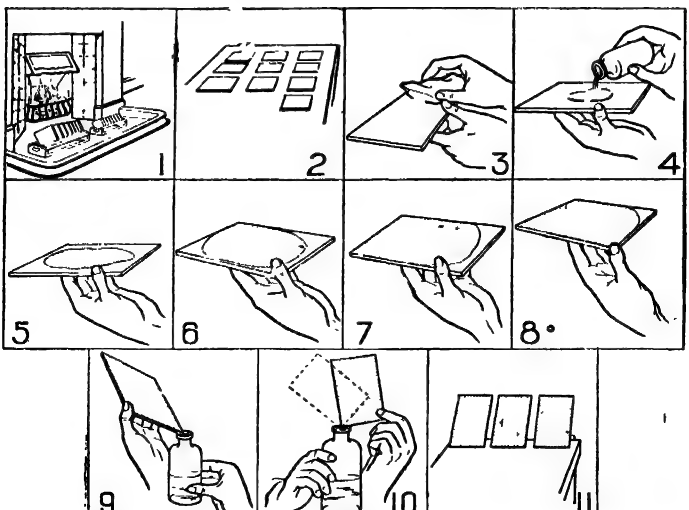
SHELLAC WATER VARNISH.

Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ozs.	800 c.c.s.

The shellac is allowed to soak in the liquid for twenty-four hours; the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves. After standing some time the liquid becomes perfectly clear and bright.

How to Varnish Negatives.

First place negatives where they will become perfectly dry, *e.g.*, near a fire (Fig. 1) or on a bath hot-water tank. Next lay out to get quite cold (Fig. 2). Remove dust with a strip of cotton plush or camel's



hair brush (Fig. 3). Poise negative on the tips of fingers, steady with thumb, and pour pool of "cold" varnish (bought, or made from one of the formulæ given above), in centre (Fig. 4), using plenty. Let pool spread of itself (Fig. 5). Now incline plate to cause varnish to flow into right-hand far corner (Fig. 6); thence into left-hand far corner

(Fig. 7); thence into left-hand near corner (Fig. 8), and then raise negative so as to flow excess of varnish back into bottle (Fig. 9). (N.B.—In tilting negative to distribute varnish, return plate to level position *a little before* varnish has reached the corner; the wave of varnish will carry the coating into corners, and you will avoid getting varnish on the glass side or up your sleeve.) As last drops run into bottle, rock negative to and fro (Fig. 10), so as to avoid a streaky coating, and as each negative is thus finished stand it on blotting-paper to dry (Fig. 11).

Film Varnishes.

The above water varnish is suitable, or the following:—

Borax	300 grs.	30 gms.
Glycerine	300 minims	30 c.c.s.
Shellac	600 grs.	60 gms.
Water	20 ozs.	1,000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	5 ozs.	250 c.c.s.

and filter.

Another good varnish for celluloid films is—

Dammar	500 grs.	115 gms.
Benzole	10 ozs.	1,000 c.c.s.

in which, after filtration, the films are immersed and then hung up to dry.

Retouching Medium.

Pale gum resin	200 grs.	230 gms.
Gum dammar	90 grs.	100 gms.
Gum mastic	20 grs.	23 gms.
Oil of juniper	1 gr.	1 gm.
Oil of turpentine	2–4 ozs.	1,000–2,000c.c.s.

The gums are powdered and added to the oils and finally enough pure asphaltum is added to give the mixture a dark amber colour when viewed through the depth of an inch.

This formula is strongly commended by Whiting in his "Retouching" as not liable to pick, rub off, or come off on after-varnishing. It takes a great deal of work.

Ground-Glass Varnish.

Sandarac	90 grs.	103 gms.
Mastic	20 grs.	23 gms.
Ether (0·720)	2 ozs.	1,000 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzole	½ to 1½ ozs.	120-700 c.c.s.

The proportion of the benzole added determines the nature of the matt obtained.

This varnish must be applied to the cold negative or the coating will not be matt.

Malachite green, aurantia, or asphaltum is used for tinting it green, yellow, or brown respectively (for handwork on back of negative).

Spotting Medium.

Indian ink	water colour chalk.
Payne's grey	water colour chalk.

Grind together with water only on a palette to match the colour of the negative.

Blocking-Out Mixtures.

No. 1.—Gamboge and vermilion red, or Payne's grey and vermilion, are ground together in water in equal parts with addition of a little gum water if a glossy surface is required.

No. 2.—Asphaltum	1 oz.	100 gms.
Wax	170 grs.	40 gms.
Carbon black	80 grs.	20 gms.
Turpentine	10 ozs.	1,000 c.c.s.

Commercial "Brunswick black" is equal to and more convenient than the above mixture.

Titles on Negatives.

The usual method is to have the words forming the title set up in type and photographed on a "process" plate. The subject negative having been made with a clear margin round it, a strip of the title negative is laid down on this margin by stripping and the clear margin then filled up with "photopake" or other blocking-out mixture except over the strip of title, which is made dense enough, in the first instance, to print white. If a clear portion in a landscape negative cannot be found (in cases where the title has to appear on the view), a piece must be cut out with a sharp knife.

STRIPPING.

Gelatine Glass Negatives.

(*Middleton and Holcroft.*)

The following is the formula and process for stripping the film from a glass negative and transferring it (with or without reversal) to a second glass-plate or other support:

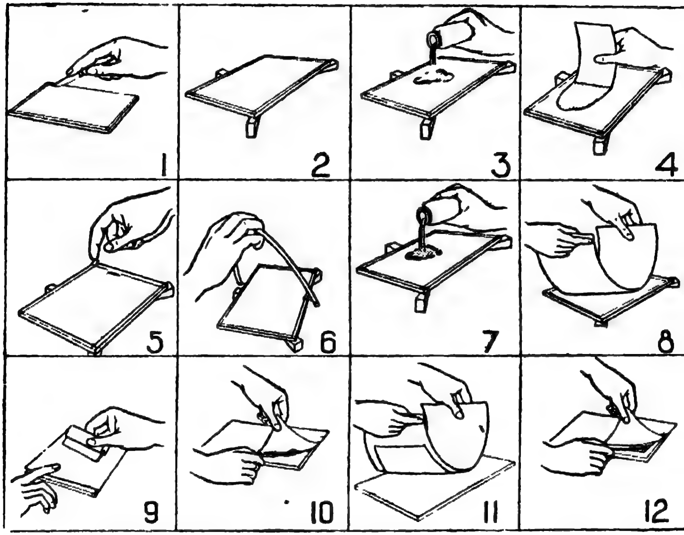
Stock solution:—

Methylated spirit	25 ozs.	250 c.c.s.
Water	1 oz.	10 c.c.s.
Glycerine	1 oz.	10 c.c.s.

To prepare the "stripping solution" 6 to 30 drops of commercial hydrofluoric acid are added to 1 oz. (30 c.c.s.) of the above.

Cut through to the glass all round negative, about ⅛ inch from edge, with sharp penknife (Fig. 1). Place level on three wooden wedges (Fig. 2). Pour on "stripping solution" (prepared as above) (Fig. 3). Spread solution with an end of paper (Fig. 4). After a minute or so try (with the finger) if the edgings of film are loose, and remove them as soon as they come away without any pull whatever (Fig. 5). Now test if whole film is loose by passing a waxed silk thread stretched on a bow of cane underneath (Fig. 6).

If all is free, pour on some plain "stock solution" (Fig. 7), and apply a sheet of waxed paper (Fig. 8). The waxed paper is prepared by soaking thin paper in hot melted paraffin for about half an hour. It is semi-transparent and free from buckle. Lightly squeegee down (Fig. 9), and then remove the two together in contact by slipping the blade of a penknife under the film (Fig. 10). Finally, apply the paper (Fig. 11), with the negative film on the under side, to a glass plate coated with very weak gum solution, dried and flowed over



with "stock solution." Then squeegee down (Fig. 9), and remove the waxed sheet, using the blade of the penknife to keep the corner of the film to the glass (Fig. 12).

A less rapid solution, but one which will be safe in the case of an old or hardened negative, is:—

Methylated spirit..	.. ..	1 oz.	80 c.c s.
Water ..	.. .. ..	2 ozs.	160 c.c.s.
Hydrofluoric acid ..	.. ..	60 minims	10 c.c.s.

These proportions may be slightly altered for different commercial spirits and acids.

Film Negatives.

In the case of negatives on celluloid cut or roll-film the following is a suitable method:—

Caustic soda	.. .. ..	10 grs.	23 gms.
Formaline ..	.. .. ..	10 minims	20 c.c.s.
Water ..	.. .. ..	1 oz.	1,000 c.c.s.

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	.. ..	25 minims	50 c.c.s.
Glycerine ..	.. .. ..	25 minims	50 c.c.s.
Water	.. ..	1 oz.	1,000 c.c.s.

in which it is removed from its original support to a glass or other base.

For stripping collodion negatives, see end of next section, "Wet Collodion and Collodion Emulsion."

WET COLLODION AND COLLODION EMULSION.

Wet Collodion.

PYROXYLINE (HARDWICH).

Sulphuric acid, 1·845	.. ..	18 ozs. (fl.)	600 c.c.s.
Nitric acid, 1·457 ..	.. ..	6 ozs. (fl.)	200 c.c.s.
Water	.. ..	5–5½ ozs. (fl.)	167 182 c.c.s.
Cotton-wool	.. .. ..	300 grs.	23 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion ten minutes.

IODISED COLLODION.

For Acid Pyro Developer.

Ether, specific gravity 0·725	..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0·805	..	4 ozs. (fl.)	400 c.c.s.
Pyroxyline ..	.. .. ..	120 grs.	27 gms.
Ammonium iodide	.. ..	30 grs.	7 gms.
Cadmium iodide ..	.. ..	45 grs.	10 gms.
Alcohol (0·830)	.. .. ..	4 ozs. (fl.)	400 c.c.s.

BROMO-IODISED COLLODION.

For Iron Developer.

Ether, specific gravity 0·725	..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0·805	..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	.. .. ..	120 grs.	27 gms.
Ammonium iodide	.. ..	40 grs.	9 gms.
Cadmium iodide	.. ..	40 grs.	9 gms.
Cadmium bromide	.. ..	20 grs.	4·5 gms.
Alcohol (0·830)	.. .. ..	5 ozs. (fl.)	500 c.c.s.

Thinning Collodion after Use.—A mixture of sulphuric ether (0·720), 3 parts, and alcohol (0·805), 2 parts, is generally used.

THE NITRATE BATH.

Silver nitrate	6 ozs.	75 gms.
Distilled water	80 ozs. (fl.)	1,000 c.c.s.
Nitric acid (pure)	8 minims	0·2 c.c.s.

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter.

DEVELOPER.

No. 1.—Ferrous sulphate	½ oz.	50 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Alcohol	½ oz.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.
No. 2.—Ferrous ammonio-sulphate ..	75 grs.	43 gms.
Glacial acetic acid	75 grs.	43 gms.
Copper sulphate	7 grs.	4 gms.
Water	4 ozs.	1,000 c.c.s.
Alcohol	¼ oz.	60 c.c.s.

INTENSIFIER.

Pyrogallic acid	90 grs.	10 gms.
Citric acid	60 grs.	7 gms.
Acetic acid (glacial)	1 oz.	50 c.c.s.
Water	20 ozs.	1,000 c.c.s.

The copper intensifier (see "Intensifiers") is used for greater density, each solution being flowed over the plate with a rinse between.

Positives and Ferrotypes by Wet Collodion.

BROMO-IODISED COLLODION.

Ether, specific gravity 0·725 ..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0·805 ..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	100 grs.	23 gms.
Cadmium iodide	50 grs.	11½ gms.
Ammonium bromide	25 grs.	5·7 gms.
Alcohol, 0·830	5 ozs. (fl.)	500 c.c.s.

Note.—The iodides should be dissolved in the weaker spirit, and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

SILVER BATH.

Silver nitrate (recryst.)	5½ ozs.	70 gms.
Distilled water	80 ozs. (fl.)	1,000 c.c.s.
Nitric acid (pure)	½ dr.	0·8 c.c.

Saturate with iodide of silver and filter as above.

DEVELOPERS.

Ferrous sulphate	150 grs.	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Nitric acid	5 minims	1 c.c.
Alcohol	½ oz.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

NITRATE OF IRON DEVELOPER.

Ferrous sulphate	1½ oz.	75 gms.
Barium nitrate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Alcohol	1 oz.	50 c.c.s.
Nitric acid	40 drops	4 c.c.s.

The insoluble barium sulphate which is formed must be filtered out.

FIXING SOLUTION.

Potassium cyanide	½ oz.	25-30 gms.
Water	15-20 ozs.	1,000 c.c.s.

DEVELOPER FOR COLLODION TRANSFERS.

Pyrogallic acid	4 grs.	9 gms.
Citric acid	3 grs.	7 gms.
Acetic acid	20 minims	41 c.c.s.
Water	1 oz.	1,000 c.c.s.
Alcohol	20 minims	41 c.c.s.

Wet Collodion for Half-Tone.

For Winter.

A.—Celloidin	190 grs.	21 gms.
Ether (0·720)	12 ozs.	600 c.c.s.
Alcohol (0·805)	8 ozs.	400 c.c.s.

For Summer.

B.—Celloidin	190 grs.	21 gms.
Ether (0·720)	10 ozs.	500 c.c.s.
Alcohol (0·805)	10 ozs.	500 c.c.s.

IODIZER.

Cadmium iodide	600 grs.	68 gms.
Ammonium iodide	210 grs.	24 gms.
Sodium iodide	210 grs.	24 gms.
Cadmium bromide	210 grs.	24 gms.
Alcohol	20 ozs.	1,000 c.c.s.

Use: Iodizer, 1 part; collodion, 15 parts; and set the mixture aside for at least 4 days to ripen. It should then be a bright yellow; if not, add to each ounce 1 minim of a solution of:—Iodine, 16 grs.; alcohol, 1 oz.

Collodion Emulsion.

PYROXYLINE FOR COLLODIO-BROMIDE OR UNWASHED EMULSION.

Nitric acid, specific gravity 1·45	2 ozs. (fl.)	285 c.c.s.
Sulphuric acid, specific gravity 1·845	4 ozs.	570 c.c.s.
Water	1 oz. (fl.)	145 c.c.s.
Cotton (cleaned and carded) ..	100 grs.	33 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.

For Washed Emulsion.

Nitric acid, specific gravity 1·45.	2 ozs. (fl.)	400 c.c.s.
Sulphuric acid, specific gravity 1·845	3 ozs.	600 c.c.s.
White blotting-paper	145 grs.	66 gms.

Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.

Collodio-Bromide Emulsion.

Ether, specific gravity 0·720 ..	5 ozs. (fl.)	620 c.c.s.
Alcohol, specific gravity 0·820 ..	3 ozs.	380 c.c.s.
Pyroxyline..	50 grs.	14 3 gms.
Cadmium ammonium bromide..	80 grs.	23 gms.
or		
Zinc bromide	76 grs.	21·5 gms.

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

Washed Emulsion (for Transparencies).

Ether, specific gravity 0·720 ..	5 ozs. (fl.)	620 c.c.s.
Alcohol specific gravity 0·820 ..	3 ozs.	380 c.c.s.
Pyroxyline or papyroxyline ..	60 grs.	17 gms.
Cadmium ammonium bromide..	100 grs.	29 gms.
or		
Zinc bromide	96 grs.	27·5 gms
Hydrochloric acid (specific gravity 1·2)	8 minims	2 c.c.s.

Sensitise with 20 grs. of silver nitrate to each ounce (4·3 gms. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol. Allow to stand for two or three days.

N.B.—In the last formula the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

Wellington's Collodio-Bromide Emulsion Formula.

Pyroxyline	30 grs.	23 gms.
Ether	12 drs.	500 c.c.s.
Alcohol	12 drs.	500 c.c.s.

To bromise, add 30 grs. (33 gms.) bromide ammonium dissolved in 45 minims (31 c.c.s.) water, to which 4 drachms (170 c.c.s.) of alcohol are afterwards added; 50 grs. (33 gms.) of nitrate of silver dissolved in a drachm (4½ c.c.s.) of water are then added. After washing and drying, the pellicle is dissolved in 1½ oz. (58 c.c.s.) of ether, and the same of alcohol.

DEVELOPER FOR COLLODION EMULSION.

An excellent developer for collodion emulsion is the following, worked out by the Bolt Court School of Photo-Engraving, London :—

Glycin	190 grs.	17 gms.
Sodium sulphite	1 oz.	40 gms.
Potass. carbonate	2 ozs.	80 gms.
Water to	25 ozs.	1,000 c.c.s.

INTENSIFYING SOLUTION FOR COLLODION EMULSION.

Silver nitrate	60 grs.	70 gms.
Citric acid	30 grs.	35 gms.
Nitric acid	30 minims	35 c.c.s.
Water	2 ozs.	1,000 c.c.s.

To each drachm of a three-grain solution of pyrogallic acid add 2 or 3 minims of the above, and apply until sufficient density is attained.

HÜBL'S CHLOR-BROMIDE COLLODION EMULSION.

Special for Colour Work.

A.—Silver nitrate	480 grs.	50 gms.
Hot distilled water	1 oz.	50 c.c.s.
Dissolve and add		
Alcohol	2 ozs.	100 c.c.s.
Nitric acid	6 drops	10 drops
Shake well, and add to		
4 per cent. collodion	10 ozs.	500 c.c.s.

Shake till any precipitated pyroxyline is redissolved, and then add in small quantities

Zinc bromide (pure anhydrous)	307 grs.	32 gms.
Absolute alcohol	2¾ ozs.	128 c.c.s.
shaking between each addition; then add		
Nitric acid	24 minims	1·5 c.c.
Hydrochloric acid	24 minims	1·5 c.c.

This should be gently warmed before adding to the collodion. Allow to stand for twenty-four to thirty-six hours, or till the emulsion appears a greyish-violet by transmitted light, then add

Zinc chloride (pure anhydrous) ..	77 grs.	3.2 gms.

or sufficient to convert the whole of the uncombined silver nitrate into chloride, which can be tested for with potassium chromate. It is advisable to dissolve the zinc chloride in about four times its volume of acid. The emulsion should then be precipitated by pouring into plenty of water, the threads collected and shaken up with alcohol and drained, and then dissolved in

Absolute alcohol	10 ozs.	500 c.c.s.
Ether, washed	10 ozs.	500 c.c.s.

Stripping Wet Collodion Negatives.

When the negative is thoroughly dry and cool, flow over with thin solution of rubber in benzole, 2 parts pure rubber to 100 parts benzole, or ordinary cycle tyre repairing solution thinned down to about the consistency of collodion will do. When this is dry, the negative is

flowed over with "leather" collodion. This is prepared by adding a small quantity of castor oil to plain collodion. A good formula is as follows:—

Celloidin	½ oz.	2 gms.
Ether	5 ozs.	50 c.c.s.
Alcohol	5 ozs.	50 c.c.s.
Castor oil	½ oz.	2 c.c.s.

When the collodion on the negative is dry (and the drying can be hastened by heat) the negative is cut round the edges with a knife and placed in a dish of cold water. The film should soon begin to loosen at the edges; if it does not a little acetic acid (up to 10 per cent.) may be added to the water. The film is now transferred to a piece of paper, and thence to the new support. If the negative is to be reversed it is transferred to another piece of paper before being placed on its final support.

PLAIN AND ALBUMEN PAPERS.

Plain Paper.

The following are formulæ for "salting" and sensitizing papers such as Whatman's drawing papers, pure Rives paper, etc.

First prepare the plain paper with—

Ammonium chloride	60–80 grs.	14–18 gms.
Sodium citrate	100 grs.	23 gms.
Sodium chloride	20–30 grs.	4·5–7 gms.
Gelatine	10 grs.	2 gms.
Distilled water	10 ozs.	1,000 c.c.s.

or—

Ammonium chloride	100 grs.	23 gms.
Gelatine	10 grs.	2 gms.
Water	10 ozs.	1,000 c.c.s.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes and dried.

The salted paper is sensitized upon a neutral 45-grain silver bath.

Platinum Toning Bath.

Potass. chloroplatinite	4¼ grs.	1 gm.
Water	10 ozs.	1,000 c.c.s.
Nitric acid	2–3 drops.	5–10 drops.

Albumen Paper.

The albumenized paper, as purchased, is sensitized on the following silver solution:—

Silver nitrate	600 grs.	140 gms.
Distilled water	10 ozs.	1,000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs.

TONING BATHS.

No. 1.—Gold chloride	.. .. ..	1 gr.	0·3 gm.
Sodium acetate	.. .. ..	30 grs.	6 gms.
Water	.. ..	8 ozs.	1,000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2.—Gold chloride	.. .. ..	15 grs.	1 gm.
Water	.. ..	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add—

Calcium chloride, fused	.. ..	120 grs.	7·7 gms.
Water to make	.. .. ..	7½ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath; it can be used over and over again by addition of stock solution.

PRESERVATIVE FOR SENSITIZED ALBUMEN PAPER.

Sensitize the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of—

Citric acid	.. ..	1 oz.	33 gms.
Water	.. ..	30 ozs.	1,000 c.c.s.

TO PREVENT BLISTERS IN ALBUMEN PRINTS.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

GELATINE P.O.P.

Emulsion Formulæ.

BARKER'S.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	.. ..	175 grs.	80 gms.
Ammonium chloride	.. ..	18 grs.	8 gms.
Rochelle salts	.. .. ..	50 grs.	23 gms.
Silver nitrate	.. .. ..	75 grs.	34 gms.
Alcohol	.. ..	4 drs.	160 c.c.s.
Water	.. ..	5 ozs.	1,000 c.c.s.

Heat to 100 degrees F. (38 degrees C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

VALENTA'S.

A.—Silver nitrate	.. .. ..	480 grs.	32 gms.
Citric acid	.. ..	120 grs.	8 gms.
Hot water	.. ..	5¼ ozs.	160 c.c.s.
B.—Gelatine	.. ..	1,440 grs.	96 gms.
Ammonium chloride	.. ..	42 grs.	2·8 gms.
Water	.. ..	24·3 ozs.	700 gms.

C.—Tartaric acid	.. .. ..	42 grs.	2·8 gms.
Sodium bicarbonate	.. ..	21 grs.	1·4 gm.
Alum	.. ..	27 grs.	1·8 gm.
Water	.. ..	5 ozs.	140 c.c.s.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50 degrees C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40 degrees to 50 degrees C. and then filter. For matt surface papers the gelatine should be reduced to 750 grs. or 80 gms.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0·05 to 0·1 per cent. of calcium bichromate solution; this can be made by dissolving 480 grs. or 25 gms. of pure chromic acid in 4 ozs. or 100 c.c.s. of distilled water, and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered, and the filter washed with distilled water up to 4 ozs. or 100 c.c.s.

BEADLE'S.

Nelson's gelatine ..	.. ..	340 grs.	112 gms.
Alum	.. ..	15 5 grs.	5 gms.
Water	.. ..	6½ ozs.	900 c.c.s.
Rochelle salts	.. .. ..	15·5 grs.	3·5 gms.
Ammonium chloride	.. ..	11 grs.	5 gms.

Heat to 50 degrees C., and add—

Silver nitrate	.. .. ..	115 grs.	37·5 gms
Citric acid ..	.. .. ..	62 grs.	20 gms.
Water	.. ..	1 oz.	100 c.c.s.

Procedure in P.O.P. Printing.

Wash prints in several changes of water until wash water ceases to show milkiness when poured into clean glass measure (time, 10 to 15 minutes). Tone in gold bath (5 to 10 minutes). Again wash as thoroughly as before toning. Fix in:—hypo, 2 to 3 ozs.; water, 20 ozs., for 10 minutes. Finally wash in running water or frequent changes (every 5 or 10 minutes) for 1 to 2 hours.

Prints can be toned in a platinum bath instead of in one of gold (see formulæ below). The other manipulations remain the same as above. The tones are best suited to matt surface paper.

Prints can be toned and fixed at the same time in a "combined" bath (see formulæ below). With some baths and papers it is best to wash before toning; with others it is not necessary. The tones by the "combined" method are almost always warmer than by separate toning and fixing. Also they are somewhat inferior in permanence.

P.O.P. prints may be printed faintly and then developed up to full strength (see "Developing P.O.P." below). The colour of the developed prints is usually not pleasing, and it is necessary to tone. This is done as a rule in a combined bath. P.O.P. to be developed

when exposed, a strong light falls upon the camera front, and a thin film of dust will cause a surprising amount of veil. In frames or examining prints. *It must be handled as though it were* "gaslight" paper.

Gold Toning Baths.

Sulphocyanide.

This is the best and most generally used toning bath for P.O.P. and yields fine purplish tones.

Gold chloride	2½ grs.	0 3 gm.
Ammonium sulphocyanide ..	30 grs.	3·5 gms.
Water	20 ozs.	1,000 c.c.s.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other—both scalding hot. Then pour the gold into the sulphocyanide in small doses, stirring all the time: use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

Concentrated Sulphocyanide.

(Bühler's Formula.)

A.—Distilled water	1 oz.	150 c.c.s.
Gold chloride	15 grs.	5 gms.
B.—Strontium chloride	150 grs.	50 gms.
Distilled water	¾ oz.	100 c.c.s.
C.—Potassium sulphocyanide ..	80-150 grs.	25-50 gms
Distilled water	1¾ oz.	250 c.c.s.

Heat B to boiling, and add A (heated to 150 degrees F.) in small doses. Bring C to boiling, and allow to cool to 205 degrees F., and add the hot mixture of A and B in four or five lots with constant stirring; cool and filter. If a precipitate forms, reheat to nearly boiling, wash the filter with ¾ oz. (100 c.c.s.) water, and add this latter to the total bulk. The bath is diluted with 10 times its volume of water for use.

Formate.

Gold chloride	1 gr.	0 12 gm.
Sodium bicarbonate	2 grs.	0·23 gm.
Sodium formate	8 grs.	0·9 gm.
Water	20 ozs.	1,000 c.c.s.

The prints should be immersed in a 10 % solution of salt and water before using this bath.

Tungstate.

Sodium tungstate..	30 grs.	3·5 gms.
Sodium carbonate..	1 gr.	0·12 gm.
Gold chloride	1 gr.	0·12 gm.
Water	10-20 ozs.	500-1,000 c.c.s.

An excellent bath for warm brown tones.

Thiocarbamide.

Gold chloride	4 grs.	0 25 gm.
Distilled water	1 oz.	25 c.c.s.

Add, to dissolve precipitate first formed, sufficient of—

Thiocarbamide	90 grs.	1 gm.
Distilled water	10 ozs.	50 c.c.s.

About ½ oz. (14 to 15 c.c.s.) will be needed. Next add—

Citric acid	8 grs.	0·5 gm.

and

Distilled water to	35 ozs.	1,000 c.c.s.

and finally

Salt	160 grs.	10 gms.

The prints should be thoroughly washed *before* as well as after fixing.

Short Stop for Gold Toning.

A weak solution of sodium sulphite (5 grs. per oz.) at once arrests the action of a gold toning bath.

Salt Bath.

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

If prints are to be toned in the platinum bath the carbonate should be omitted.

Platinum Toning Baths.

Phosphoric Acid.

Potass. chloroplatinite	4 grs.	0·45 gm.
Phosphoric acid (sp. gr. 1·12) ..	¾ oz. (fl.)	35 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

Citric Acid.

Potass. chloroplatinite	4 grs.	0 45 gm.
Sodium chloride (salt)	40 grs.	4·5 gms.
Citric acid	50 grs.	5 8 gms.
Water to	20 ozs.	1,000 c.c.s.

Haddon's Formula.

Platinum perchloride	3 grs.	0 2 gm.
Sodium formate	100 grs.	6 5 gms.
Formic acid	30 minims	1·8 c.c.
Water to	35 ozs.	1,000 c.c.s.

Short Stop for Platinum Toning.

A weak solution of sodium carbonate (10 grs. per oz.) instantly arrests the toning action of a platinum bath.

For Black Tones.

Tone in— (*Valenta.*)

Potass. chloroplatinite	2½ to 10 grs.	0·5 to 2 gm.
Metaphenylene-diamine	2½ to 10 grs.	0·5 to 2 gm.
Water	10 ozs.	1,000 c.c.s.

having first washed the prints well.

Another method is to print deeply and immerse the prints in—

Salt	1 oz.	25 gms.
Sodium bicarbonate	80 grs.	9 gms.
Water	20 ozs.	1,000 c.c.s.

then wash well and tone in a borax gold bath to a purple red. Again well wash and tone in the phosphoric platinum bath.

For Red.
(Valenta.)

Uranium nitrate	10–20 grs.	1–2 gms.
Thiosinamine	90 grs.	10 gms.
Water	20 ozs.	1,000 c.c.s.

The prints are well washed, finally in water acidulated with acetic acid, and then toned. They are afterwards fixed, or can be toned to sepia brown in the combined bath.

Gold-Platinum (One Solution).

Citric acid	90 grs.	10 gms
Salt..	90 grs.	10 gms.
Potass. chloroplatinite	4-8 grs.	½-1 gm.
Gold chloride	4-8 grs.	½-1 gm.
Water	20 ozs.	1,000 c.c.s.

Twice the amount of water may be used if the bath acts too quickly. If the proportion of gold to platinum is increased the tone is warmer. The prints must be well washed before fixing.

Combined Baths.

Valenta's.

Hypo	8 ozs.	400 gms.
Ammonium sulphocyanide ..	1 oz.	50 gms.
Lead nitrate	175 grs.	20 gms.
Alum	350 grs.	40 gms.
Water to	20 ozs.	1,000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120 deg. F. for ten minutes; allow to cool. For use take—

Stock solution (as above) ..	10 ozs.	100 c.c.s.
Water	10 ozs.	100 c.c.s.
Gold chloride (from stock sol.)..	3½ grs.	0·23 gm.

Alkaline Toning and Fixing Bath.

Gold chloride	2 grs.	0·23 gm.
Lead nitrate	10 grs.	1·2 gm.
Chalk	½ oz.	25 gms.
Hypo	4 ozs.	200 gms.
Water	20 ozs.	1,000 c.c.s.

Shake the solution well, allow to settle, and use the clear portion. If prints tone too quickly, under 10 minutes, in the combined bath, it is best to pass them afterwards through a plain fixing bath.

Reducer for Over-Printed Proofs.

A.—Ammonium sulphocyanide	10% sol.
B.—Potass. ferricyanide	10% sol.

A, 5 ozs.; B, ½ oz.; water, 24 ozs.

This is used on the prints after toning, fixing and well washing out the hypo in the usual way.

Developing P.O.P.

Direct Process with Acid Developer.

Hydroquinone	16 grs.	18·5 gms.
Citric acid	40 grs.	4·6 gms.
Sodium acetate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

Immerse the dry prints in the developer, and, after development, wash in plenty of water for ten or fifteen minutes, then tone in the usual way.

Pyro (Blacklock).

A.—Pyro	40 grs.	4·6 gms.
Tartaric acid	40 grs.	4·6 gms.
Water	20 ozs.	1,000 c.c.s.

Will keep three or four weeks.

B.—Potass. bichromate	$\frac{1}{16}$ gr.	0·009 gm.
Water	16 ozs.	1,000 c.c.s.

B is best made up from a stock solution of 1 gr. per ounce, adding ½ dr. of it to 16 ozs. of water. To develop, mix equal parts of A and B.

Six or seven inches of magnesium ribbon burnt close to the frame, will suffice for the exposure.

The fixing bath is:—

Hypo	3½ ozs.	160 gms.
Lead acetate	200 grs.	23 gms.
Water	20 ozs.	1,000 c.c.s.

in which the prints lose very little.

Paget "Bromide" Process.

The prints are immersed in 10 per cent. potass. bromide solution for five or ten minutes, washed and developed with the following:—

A.—Hydroquinone	40 grs.	4·5 gms.
Sodium sulphite	160 grs.	18 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Potass. bromide	2½ ozs.	125 gms.
Sodium carbonate ..	2 ozs.	100 gms.
Water to	20 ozs.	1,000 c.c.s.
C.—Potass. cyanide	½ oz.	25 gms.
Water	20 ozs.	1,000 c.c.s.

For average negatives, mix:—A, ½ oz.; B, 1 oz.; C, 20 minims; water, ½ oz.

For flat negatives (greater contrast), A, 3 drs.; B, 1 oz.; water, 5 drs.

For hard negatives (soft results), A, 7 drs.; B, 1 oz.; water, 1 dr.

The cyanide solution is used as above in quantity sufficient to keep the backs of prints clean.

Glazing P.O.P.

POLISH FOR SQUEEGEEING GLASSES.

A polishing medium to be applied to glass or ferrotype before squeegeeing the print is—

Beeswax	20 grs.	45 gms.
Turpentine	1 oz.	1,000 c.c.s.
or		
Spermaceti wax	20 grs.	45 gms.
Benzole	1 oz.	1,000 c.c.s.

a few drops of which are rubbed on with a piece of flannel, and the glass afterwards polished with silk rag or chamois leather.

ENAMEL COLLODION.

Soluble gun cotton	50 grs.	14 gms.
Alcohol	4 ozs.	500 c.c.s.
Sulphuric ether	4 ozs.	500 c.c.s.

Glass plates cleaned with French chalk are coated with the above, and, as soon as coating has set, slipped under prints which are waiting face down in water. Prints are withdrawn and squeegeed. When half dry they are given a backing paper and finally stripped off. (For both gelatine and collodion prints.)

COLLODIO-CHLORIDE P.O.P.

Emulsion Formula.

(*Valenta.*)

1.—	Strontium chloride	154 grs.	10 gms.
	Lithium chloride	77 grs.	5 gms.
	Water	500 minims	30 c.c.s.
	Alcohol (absolute)	930 minims	55 c.c.s.
2.—	Silver nitrate	400 grs.	20 gms.
	Water	500 minims	30 c.c.s.
	Alcohol	1,000 minims	60 c.c.s.
3.—	Citric acid	77 grs.	5 gms.
	Alcohol	675 minims	40 c.c.s.
	Glycerine	92 grs.	6 gms.

In a bottle capable of holding 1,000 parts pour 350 parts of 3 per cent. collodion and add gradually 15 parts of No. 1. Then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after

each addition; then add 50 parts of No. 3 and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0·1 to 0·4 per cent. calcium chromate solution is added. By reducing the amount of pyroxyline in the above formula the emulsion is more suitable for matt surface paper.

Procedure in C.C. Printing.

Prints are washed in changes of water until latter is free from milkiness, and then toned either with gold or platinum, but most usually and for the best warm black tones, first in gold and then (after washing) in platinum. They are then again well-washed and fixed like gelatine P.O P. prints. C.C. prints as a rule do not yield the best results in the combined bath. C.C. papers are not suitable for the "development" process described under Gelatine P.O.P.

Gold-Platinum Toning.

For Black Tones.

The following is the usual practice in toning collodion prints :—

Wash in several changes, and tone the shadows to a brown (when seen by transmitted light) in the following :—

Borax	90 grs.	10 gms.
Gold chloride	2 grs.	0·2 gm.
Water	20 ozs.	1.000 c.c.s.

This bath is ready within a few minutes of mixing. It is conveniently made just before washing the prints. The quantity of borax is adjusted to the working. If the lighter tones disappear, add more borax; if the prints lack brilliance, add gold. After a ten-minute wash, transfer to the platinum bath, which may be strong or weak, the only difference being that a larger number of prints may be treated together in the weaker bath.

Stock solution.—

Potass. chloroplatinite	30 grs.	7 gms.
Phosphoric acid (specific gravity 1·12)	5 drs.	30 c.c.s.
Water to make	20 ozs.	1,000 c.c.s.

This may be made up to 60 ozs. at once, or added little by little to water, as the prints are passed through a few at a time.

The prints are next washed in about eight changes of water (to the fifth or so of which it is well to add a little of bicarbonate of soda to neutralise traces of acid) before fixing.

Gold Toning Baths.

BORAX-ACETATE.

Borax	90 grs.	10 gms.
Sodium acetate	90 grs.	10 gms.
Gold chloride	2½ grs.	0·3 gm.
Water	20 ozs.	1,000 c.c.s.

SULPHOCYANIDE.

Ammonium sulphocyanide ..	90 grs.	10 gms.
Gold chloride	2½ grs.	0·3 gm.
Water	20 ozs.	1,000 c c.s.

For bluish-black tones.

SULPHOCYANIDE-ACETATE.

Ammonium sulphocyanide ..	35 grs.	4 gms.
Sodium acetate	⅞ oz.	45 gms.
Gold chloride	5 grs.	0·6 gm.
Water	20 ozs.	1,000 c.c.s.

Is made up one hour before using, preferably from stock solutions of the substances. With sodium tungstate, instead of the acetate, gives fine chestnut tones.

The maker's formulæ should be studied in connection with the above baths as papers differ considerably in the quantity of gold required in the toning solution.

Platinum Toning Baths.

The phosphate formula given below under "Gold Platinum Toning" is suitable for the production of the warm brown and sepia tones, which are given by the platinum baths alone. Others are :—

Citric acid	45 grs.	5 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

Lactic acid (specific gravity 1·21)	25 grs.	3 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

SALT-BICARBONATE BATH.

The following is used between washing and toning with the platinum bath as a means of removirg free silver, and bringing the prints into a state of regular neutrality :—

Salt	½ oz.	25 gms.
Sodium bicarbonate	45 grs.	5 gms.
Water	20 ozs.	1,000 c.c.s.

Toning Baths for Various Warm Tones.

For Warm Sepia Tones.

The prints are washed in three changes of warm water and placed in :—

Ammonia	1 dr.	6 c.c.s.
Warm water	20 ozs.	1,000 c.c.s.

until they become lemon yellow. They are then again washed in three changes of water and toned for about one minute in the gold borax bath above.

For Red Chalk Tones.

The prints are washed in a couple of changes of water and placed for about half an hour (until they become orange-yellow) in :—

Salt..	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

After which they are washed for about one minute and toned, for a few seconds only, in the borax bath above.

For Violet Tones.

Print deeply from the negatives and tone until the colour desired is reached in :—

Hydrochloric acid	6 ozs.	300 c.c.s.
Gold chloride	10 grs.	1·2 gm.
Water to make	20 ozs.	1,000 c.c.s.

After which wash thoroughly and fix in 5 per cent. hypo. Less acid in the above bath tends to bluish-violet, more to violet purple.

Combined Baths.

Collodion papers, although not generally suitable for use with the combined bath, may in some cases be toned in it. The Valenta formula (see "Gelatine P.O.P." above) is suitable, also the following (Kurz) :—

Water	20 ozs.	1,000 c.c.s.
Hypo	5 ozs.	250 gms.
Ammonium sulphocyanide ..	240 grs.	28 gms.
Alum	70 grs.	7·5 gms.
Citric acid	70 grs.	7·5 gms.
Lead nitrate	90 grs.	10 gms.
Lead acetate	90 grs.	10 gms.
Gold chloride	$3\frac{1}{2}$ grs.	0·4 gm.

It is turbid when first made, but clears after a few days.

BROMIDE AND GASLIGHT PAPERS.

Procedure.—Bromide paper must be handled in yellow or orange light: gaslight can be worked in weak day or artificial light. Bromide papers develop in from two to five minutes, whilst many (but not all) gaslight papers develop in a second or two. Apart from these distinctions the general working of the two classes of paper is the same, viz., exposure which has no visible effect on the paper; development; a brief rinse; fixing in,—hypo, 3 to 4 ozs.; water, 20 ozs.;

and thorough washing in running water or frequent changes, say for one hour.

The following developers are a few only of the standard. The "Makers' Formulæ" should be consulted.

Amidol.

Sodium sulphite	650 grs.	74 gms.
Potass. bromide	10 grs.	1·2 gm.
Water	20 ozs.	1,000 c.c.s.
When dissolved add—		
Amidol	50 grs.	5·7 gms.

This developer will not keep more than three days.

See also the formula given under "Negative Developers."

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite, and add 5 grs. potassium bromide to each 10 ozs. solution. For use add 4 grs. dry amidol to each ounce stock solution, and dilute with an equal bulk of water.

Eikonogen-Hydroquinone.

(See under "Developers and Development.")

Metol.

A.—Metol	100 grs.	11·5 gms.
Sodium sulphite	2 ozs.	100 gms.
Potass. bromide	12 grs.	1·4 gm.
Water	20 ozs.	1,000 c.c.s.
B.—Potass. carbonate	2 ozs.	100 gms.
Water	20 ozs.	1,000 c.c.s.

For use take 3 ozs. of A and 1 oz. of B.

For gaslight papers use half the quantity of water in above formula.

Metol-Hydroquinone.

Metol	8 grs.	1 gm.
Hydroquinone	30 grs.	3·5 gms.
Sodium sulphite	¾ oz.	37·5 gms.
Sodium carbonate	¾ oz.	37·5 gms.
10% solution of potass. bromide	20 minims	2·5 c.c.s.
Water	20 ozs.	1,000 c.c.s.

For gaslight papers make up above formula with 10 ozs. of water.

Rodinal.

Rodinal	100–150 minims	6–9 c.c.s.
Water	10 ozs.	300 c.c.s.
10% solution of potass. bromide	20 minims	1 c.c.

Ortol.

A.—Ortol	..	120 grs.	14 gms.
Potass. metabisulphite	..	60 grs.	7 gms.
Water	..	20 ozs.	1,000 c.c.s.
B.—Sodium sulphite	..	4 ozs.	200 gms.
Potass. carbonate	..	1 oz.	100 gms.
Potass. bromide	..	20 grs.	2·3 gms.
Water	..	20 ozs.	1,000 c.c.s.

Use equal parts of A and B.

For gaslight papers use half the quantity of water given in this formula.

Ferrous Oxalate.

A.—Sulphate of iron	..	5 ozs.	250 gms.
Sulphuric acid	..	30 minims	3 c.c.s.
Warm water to	..	20 ozs.	1,000 c.c.s.
B.—Potass. oxalate (neutral)	..	5 ozs.	250 gms.
Potass. bromide	..	10 grs.	1·2 gm.
Warm water to	..	20 ozs.	1,000 c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versâ*.

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

Acid Bath.

Glacial acetic acid	..	1 dr.	6 c.c.s.
Water	..	20 ozs.	1,000 c.c.s

Then wash thoroughly to remove last trace of acid.

Clearing Bath.

To remove yellow stain from bromide prints, the following is suitable:—

Alum (saturated solution)	..	10 ozs.	1,000 c.c.s.
Hydrochloric acid	..	3 drs.	40 c.c.s.

Reducer for Bromides.

Over-developed prints are best treated in a weak iodine-cyanide reducer made from (A) 10% solution of iodine in potass. iodide and (B) 10% potass. cyanide solution. Take:—

A.	..	30 minims	2 c.c.s.
B.	..	10 minims	0·6 c.c.
Water	..	2 ounces	60 c.c.s.

Adding more of A and B if necessary.

Strong Prints from Flat Negatives.

The prints are fully exposed and over-developed, fixed and washed. They are then placed in the following iodine bath until whites are strongly blue, and then fixed for five minutes.

IODINE BATH.

Potass. iodide	.. .. ..	30 grs.	7 gms.
Iodine	.. ..	3 grs.	0·7 gm.
Water	.. ..	10 ozs.	1,000 c.c.s.

If not sufficiently lightened, the print may be washed and the process with bleaching bath and hypo repeated.

Hypo-Alum Toning.

The following is a method (much used on the commercial scale) for toning bromide prints to a warm purplish sepia:—

Hot water	.. ..	20 ozs.	1,000 c.c.s.
Hypo	.. ..	2½ ozs.	125 gms.

Dissolve and add—

Alum	.. ..	½ oz.	25 gms.

This mixture should not be filtered, and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried.

A new bath tends to reduce the prints rather more than an old one.

When toned the prints should be placed in a tepid solution of—

Water	.. ..	70 ozs.	1,000 c.c.s.
Alum	.. ..	2 ozs.	30 gms.

and then washed thoroughly.

Sulphide Toning.

Of the many methods of producing sepia to warm brown tones on bromide or gaslight the following is the best and most reliable. Prints require to be well washed from hypo before being put into the bleacher. In summer, or in places where the water supply has a softening action on prints, it is well to fix them in a fixing-hardening bath. (See "Fixing.")

BLEACHER.

Ammonium bromide	.. ..	100 grs.	11 gms.
Potass. ferricyanide	.. ..	300 grs.	35 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

SULPHIDE BATH.

It is best to keep the sulphide in strong, 20 per cent., solution; a weak solution does not keep well. Use the pure *white* sulphide, dissolving 4 ozs. in water and making up to 20 ozs.

To make the working sulphide bath, mix:—

Stock 20% sulphide solution	.. .. ..	3 ozs.
Water to make	.. ..	20 ozs

The prints are treated for two or three minutes in the bleacher—that is, until the picture becomes faint brown in colour. If any black is left at the end of two minutes it is a sign that the bleacher (which may be used repeatedly) is becoming exhausted.

Rinse in clean water for half-a-minute to one minute. Longer washing at this stage does no good and may lead to impaired tone.

Transfer to sulphide bath, where prints should darken to the full brown or sepia in a second or two.

Throw away the sulphide bath after the day's use. Stale spoilt sulphide solution is the most frequent cause of bad tones or of refusal of prints to darken in the sulphide bath.

Finally wash for half-an-hour in running water.

The results by the sulphide process are quite permanent.

Copper Toning.

This process yields a range of tones from warm black to red chalk, the warmth of tone increasing as the solution acts on the print. The process does not intensify the prints; it is cheap and the results are permanent

A.—Copper sulphate	.. .. ..	60 grs.	7 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	50 grs.	6 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of each. If prints are pinkish in the high-lights, use more citrate in the A or B solution.

Platinum Toning.

Not for Gaslight Prints.

Potass. chloroplatinite	.. ..	12 grs.	0 8 gm.
Mercuric chloride	.. .. ..	6 grs.	0·4 gm.
Citric acid	.. ..	54 grs.	3·4 gms.
Water	.. ..	6 ozs.	170 c.c.s.

This bath should be made up fresh for use from stock solutions. Gives warm sepia tones, with slight staining of high-lights. For cold sepia tones and absence of staining add 30 minims 10 per cent. solution potassium bromide to above. Wash well after toning

Uranium Toning.

This old method* yields brown to reddish tones. It intensifies the prints, and the results often prove impermanent.

A.—Uranium nitrate	.. .. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo. After toning wash in several changes of *still* water till the high-lights

are clear. Washing in running water will remove the toning in patches. Citric acid (10 grs. per oz.) or oxalic acid (5 grs. per oz.) instead of acetic is an aid to pure whites.

Green Tones.

Vanadium chloride	20 grs.	1 gm.
Ferric chloride	10 grs.	0·5 gm.
Ferric oxalate	10 grs.	0·5 gm.
Potassium ferricyanide	20 grs.	1 gm.
Oxalic acid (sat. sol.)	2½ ozs.	60 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

Dissolve the vanadium salt in hot hydrochloric acid and a little water. Add the ferric chloride and oxalate to the oxalic acid solution diluted with half the water, then add the ferricyanide dissolved in water, stirring well, and finally the vanadium. Tone till the prints turn blue, and then wash till they are green. Yellowish stain of the whites is removed by a weak (2 grs. per oz.) solution of ammonium sulphocyanide.

Blue Tones.

10% solution ferric ammonium citrate	2 ozs.	10 c.c.s.
10% solution potassium ferricyanide	2 ozs.	10 c.c.s.
10% solution acetic acid.. ..	20 ozs.	100 c.c.s.

The well-washed prints are immersed in this bath until the desired tone is given. Then well wash until high-lights are clear. This bath intensifies the image.

Gold Toning.

This process considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Ammonium sulphocyanide ..	30 grs.	2 gms.
Chloride of gold	2 grs.	0·13 gm.
Boiling water	4 ozs.	110 c.c.s.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry.

* * * * *

Practically all the above toning solutions can be employed for lantern plates.

Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drs. (fl.)	25 c.c.s.
Water	20 ozs.	1,000 c.c.s.

Or in—

Iodine sol. (10 per cent. in potass. iodide sol.)	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)..	5 minims	1 c c.
Water	1 oz.	100 c.c.s.

THE CARBON PROCESS.

Procedure.—Tissue, *i.e.*, paper coated with a mixture of gelatine and pigment colour, is made sensitive by immersion in bichromate solution, dried, and printed under the negative by daylight. As the colour of the tissue hides the effect of light, the printing is done by aid of an actinometer.

The effect of the light is to render the gelatine insoluble—deeper down into the tissue, the greater the action. "Development" consists in dissolving out in warm water the tissue which remains soluble, As a skin of insoluble tissue is formed over the whole top surface of the print, the coating is first transferred (face down) on to a fresh support. To do this, the exposed tissue is soaked in cold water along with a sheet of (gelatine-coated) transfer paper, the two squeegeed together, put under pressure for about 20 minutes, and then placed in hot water. The original support of the sensitive surface is stripped off, leaving the tissue with its face (the insoluble side) on the transfer paper. The soluble gelatine can be then dissolved away (development), carrying the pigment with it, and the prints are finally passed through an alum bath, washed and dried. As this transference of the print to a new support causes the picture to appear reversed as regards right and left, it is necessary (where this is an objection) to transfer first on to a "temporary support," and from this again on to the "final support" for development.

Sensitising Solutions.

Potass. bichromate	1 oz.	35-50 gms.
Water	20–30 ozs.	1,000 c.c.s.
Liquor ammonia (0·880).. ..	60 minims	6 c.c.s.

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising, the degree of squeegeeing (light or heavy) also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

The following has been recommended:—

Potass. bichromate	1 oz.	20 gms.
Water	50 ozs.	1,000 c.c.s.
Citric acid	¼ oz.	5 gms.
Liquor ammonia	q.s. to change tint of solution to lemon yellow.	

This bath is suitable for thin negatives, *i.e.*, those lacking in contrasts, and the tissue sensitised in it will keep longer than that sensitised in the former solution. The tissue, however, is much less sensitive, and with vigorous or contrasty negatives, such as are best suited for carbon work, it is apt to yield prints that are hard, through the washing away of the more delicate tones in the development.

FIXING OR HARDENING BATH.

Alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

Waxing Solutions.

FOR CARBON PRINTS, OR FOR REMOVING COLLODION FILMS.

No. 1.—Beeswax	20 grs.	10 gms.
Benzole rect. No. 1	4 ozs.	1,000 c.c.s.

FOR FLEXIBLE SUPPORTS (AUTOTYPE).

No. 2.—Yellow resin	180 grs.	42 gms.
Yellow beeswax	60 grs.	14 gms.
Rectified spirits of turpentine	10 ozs.	1,000 c.c.s.

Gelatine Solutions.

For transferring carbon pictures from flexible support to ivory, opal, glass, &c.

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water	12 grs.	1·4 gm.

For coating drawing-papers for the single transfer process—

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) water	20 grs.	2·3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

SUBSTRATUM FOR CARBON TRANSPARENCIES.

Nelson's No. 1 gelatine	¾ oz.	37 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate	12 grs.	1·4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

TO REMOVE BICHROMATE STAINS FROM FINGERS, NAILS.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

THE OIL PROCESS.

Procedure.—Gelatine-coated paper is sensitised with bichromate, printed under the negative, and treated in cold water. The faint image has the power of fixing greasy ink. This is applied with a brush, usually accentuating or suppressing parts of the subject at the worker's discretion.

Double-transfer papers, as used in the carbon process or other papers (gelatine-coated), sold for the purpose, are sensitised in a solution of bichromate of potash of 5 per cent. strength as for carbon printing. The citric acid sensitiser given above under "Carbon" is very suitable, but the most satisfactory method on the whole is the use of a quick-drying spirit sensitiser.

SPIRIT SENSITISER.
(*Demachy*)

Prepare 6 per cent. ammonium bichromate by dissolving 1½ ozs. of this salt in 25 ozs. of water.

To make the sensitiser mix at time of use:—

Stock bichromate solution	1 part
Alcohol, pure, 90°	2 parts

The sensitiser is applied with a flat hog-hair brush, about ¾ oz. serving for six 10 × 8 sheets of transfer paper.

The paper dries in about 18 minutes, and is printed under the negative until it shows a brown image somewhat as in the platinotype process. The detail should show in the high-lights. It is then soaked in several changes of water to remove the yellow bichromate (about 20 minutes), and then soaked for a further time (in a dish of water), depending on the thickness of the gelatine coating. An average time is 30 minutes; 2 to 3 hours for more heavily coated papers. The temperature of the water should be between 65° and 70° F., and should be kept steady by placing the dish in a place at this temperature. The print can be pigmented forthwith, or dried for pigmenting later on. If it is dried it requires about an hour's soaking in water at 65° to 70° F. to bring it into the best condition for pigmenting.

THE BROMOIL PROCESS.

In this form of the oil process a bromide print or enlargement is treated so as to remove the image and at the same time bring the print into the same condition as that produced by exposure of sensitised paper in the oil process.

C. Welborne Piper's Formula.

The bromide enlargement must be fully exposed and developed, using a slow-acting amidol developer for preference, and it must

be thoroughly fixed, washed, and dried. It is then bleached in—

Ozobrome solution	4 parts
Potash alum, 10% solution	4 parts
Citric acid, 10% solution	1 part
Water to make	20 parts

It is washed and then immersed in sulphuric acid (1 part to 20 water) for from 2 to about 5 minutes, again washed by soaking for a few minutes, and then fixed for 2 or 3 minutes in—

Hypo	2 ozs.
Soda sulphite	½ oz.
Water to make	20 ozs.

After this it is washed again and then pigmented like an ordinary oil print. The solutions and washing water used should not be under 60 deg. or over 70 deg. F., and the preparation of the print should not occupy longer than 20 minutes.

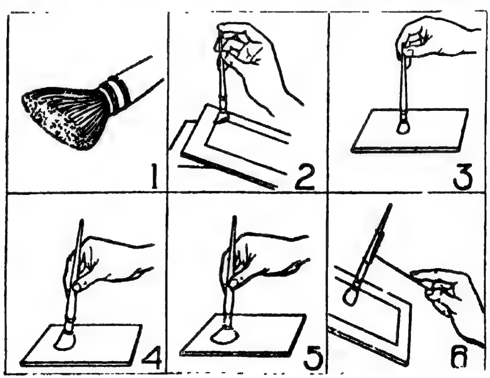
The ozobrome solution used is that specially supplied for bromoil by the Ozobrome Company.

The above is the process originally published by Mr. Welborne Piper, and is still as reliable a method as any. For alternative bleachers, &c., which have been proposed, see "Epitome of Progress," B.J.A., 1909, p. 618; 1910, p. 571; 1911, p. 587; 1912, p 628; 1913, p. 672, and under "Bromoil" in the present volume.

Pigmenting Oil and Bromoil Prints.

The brush chiefly used is the pied de biche, or hare's foot, of dome shape (Fig. 1).

In dabbing on pigment, rest elbow on table, press bristles at toe



of brush first on paper, and bend and spread a little before heel comes down (Fig. 2).

Another touch is to hold brush lightly between first two fingers and thumb, lower brush on to print, and dab four or five times a second, the brush hardly leaving surface (Fig. 3).

Or hold brush (firmly) lower down (Fig. 4)

And apply vigorously, with slight dragging action, from heel to toe for strong effects (Fig. 5).

In "hopping," hold brush on wire and apply in taps, coming an inch or so from print each stroke (Fig. 6); lightens light and strengthens dark tones.

PLATINUM PRINTING.

In the platinum process, paper is coated with a mixture of sensitive iron (ferric) salts with which are platinum salts. By exposure to light the ferric salts become reduced to ferrous salts, and then are able to reduce the platinum in the paper as a black or sepia deposit, forming a highly permanent print. The "developer" in which this takes place is a solution by which the ferrous salts are brought into a soluble state. The developer is used hot or cold, according to the nature of the paper and the kind of tone required.

Sensitisers for Cold Bath Papers (Hübl).

STOCK SOLUTIONS.

Standard Iron Solution.—In glass measure about 3 ins. diameter and 12 ins. high (marked to show a volume of 85 c.c.s.), place 52 gms. powdered iron ammonium alum, and add about 20 c.c.s. ammonia (0·880) and 20 c.c.s. water. Stir up the alum powder with a glass rod, and allow to stand several minutes, with frequent shaking. The whole should smell slightly of ammonia; if it does not a little more is added. The measure is then filled with water, the precipitate of ferric hydroxide stirred up, the glass rod removed, and the ppt. left to settle. The clear liquid is poured off, fresh water poured on, and the stirring and settling repeated until the solution no longer colours red litmus-paper blue. Powdered oxalic acid (21·5 gms.) is then dusted on the ppt., after pouring off the last washing water, and (in yellow light from this point) stirred in until the mixture clears. It is poured into a 100 c.c. measure, and diluted (with rinsings from the cylinder) to 100 c.c.s. Process occupies three to four hours.

Lead-Iron Stock Solution.—Dissolve lead acetate (10 gms.) in warm water (100 c.c.s.), and add oxalic acid (4 gms.) dissolved in a little water. A white precipitate of lead oxalate is produced, and is filtered, washed, and shaken up, with Standard Iron Solution in proportion of 1 gm. per 100 c.c.s. Finally, filter.

Oxalic-Gelatine Solution. — Soak gelatine (2 gms.) in water (20 c.c.s.), and add oxalic acid (½ gm.). Warm before use. Keeps only a day or two.

Stock Platinum Solution.—Potash chloroplatinate, 1 gm.; water, 6 c.c.s.

Mercury Citrate Solution.—Dissolve yellow mercuric oxide (1 gm. in water, 20 c.c.s.; citric acid, 5 gms., warm and filter.

SENSITISERS.

The quantities are for a 20 by 30 inch sheet. Water is added for medium (2 to 3 c.c.s.) and for rough (3 to 8 c.c.s.) papers.

A.—Lead-iron solution	4·5 c.c.s.
Stock platinum solution	3 c.c.s.

For black tones on gelatine-sized Rives papers.

B.—Lead-iron solution	4·5 c.c.s.
Stock platinum solution	3 c.c.s.
Oxalic-gelatine solution	1 c.c.

For blue-black tones on arrowroot-sized papers.

For more brilliant prints 5 to 10 drops of 10% solution of sodium chloroplatinate are added to either of the above.

Sepia Paper Sensitisers.

HOT DEVELOPMENT.

Standard iron solution	6 c.c.s.
Stock platinum solution	4 c.c.s.
Mercuric chloride (1 in 20 solution)	0·2 to 1 c.c.
Sodium chloroplatinate (10% solution) ..	2 to 10 drops.

COLD DEVELOPMENT.

Standard iron solution	8 c.c.s.
Stock platinum solution..	4 c.c.s.
Mercury citrate solution..	1 to 4 c.c.s.
Sodium chloroplatinate (10% solution) ..	2 to 5 drops.

For rough papers 2 to 4 c.c.s. of water are added.

Procedure in the Platinum Process.—Prints are developed by floating for from 15 seconds to 1 minute on a bath, the chief chemical in which is always potash oxalate. Without washing, they are placed in a bath (No. 1) of 1:80 pure hydrochloric acid for 5 minutes, into a second bath for 5 minutes, again into a third, and are then washed in running water for 15 minutes. Time in all, about half-an-hour.

Cold Bath Developers.

Potass. oxalate	2 ozs.	100 gms.
Potass. phosphate..	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

FOR SEPIA TONES ON COLD BATH BLACK PAPER.

A.—Potass. oxalate	2 ozs.	20 gms.
Water	15 ozs.	150 c.c.s.
B.—Potass. citrate	160 grs.	23 gms.
Citric acid	250 grs.	39 gms.
Mercuric chloride..	95 grs.	14 gms.
Water	15 ozs.	1,000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Another Formula.

Prepare the following solutions :—

1.—Potass. oxalate	.. .. ..	4 ozs.	250 gms.
Distilled water	.. .. ..	16 ozs.	1,000 c.c.s.
2.—Cupric chloride	.. .. ..	124 grs.	35 gms.
Distilled water	.. .. ..	8 ozs.	1,000 c.c.s.
3.—Mercuric chloride	.. .. ..	1 oz.	62 gms.
Distilled water	. .. ..	16 ozs.	1,000 c.c.s.
4.—Lead acetate	.. .. ..	32 grs.	18 gms.
Distilled water	.. .. ..	4 ozs.	1,000 c.c.s.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 175 degrees F., and the prints developed in it in the usual way and treated to the usual acid clearing baths, then immersed in ammonia solution (about 10 minims per oz.) for 5 minutes, and washed and dried.

Developer for Sepia Paper.

HOT BATH.

Potass. oxalate	.. .. ..	2 ozs.	100 gms.
Potass. phosphate	.. .. ..	1 oz.	50 gms.
Citric acid	.. ..	180 grs.	20 gms.
Potass. chloride	.. .. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Various Platinum Formulæ.

RECOVERING OVER-EXPOSED PRINTS.

Immerse for about two minutes in the oxalate developer. Transfer for one second to a bath of 1 to 20 hydrochloric acid. Return to the developer, and treat as usual.

INTENSIFIER FOR PLATINUM PRINTS.

A.—Sodium formate	.. .. ..	45 grs.	100 gms.
Water	.. ..	1 oz.	1,000 c.c.s.
B.—Platinum perchloride	.. ..	10 grs.	1 gm.
Water	.. ..	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. of water (3 c.c.s. to 100 c.c.s.).

RESTORING YELLOWED PRINTS.

Shake up bleaching powder with about five times its weight of water, pass through a sieve, and to the portion which passes through add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

CLEANING SOILED PRINTS.

Alum (one teaspoonful) is dissolved in about 8 ozs. of water, and mixed in a basin with a handful of flour to a cream-like consistency. This mixture is applied to the platinum print with a soft brush, and washed off in running water.

Platinum Residues.

Exhausted developers—the acid baths will not repay recovery—are mixed in a large jar, with zinc and hydrochloric acid (spirits of salt will do). A dirty chalk-like precipitate is accumulated, and the clear liquor is thrown away. The platinum is precipitated in the mud, and the latter, when enough has accumulated, is sent to the refiners, after being drained from water as much as possible on a linen cloth.

Waste prints, clippings from paper, etc., should be sent as they are or burnt to an ash in a place free from draught, such as a biscuit tin with a row of holes about half way up. They should not be mixed with the wet residues, as the two require different treatment for the extraction of the metal.

IRON PRINTING PROCESSES.

Ferro-Prussiate Sensitiser.

This ferro-prussiate or "blue" paper gives prints of Prussian blue colour from ordinary (brilliant) negatives. From line drawings, plans, etc., it supplies copies in white lines on a blue ground.

A.—Ferric ammonium citrate (green)*	110 grs.	250 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. ferricyanide	40 grs.	90 gms.
Water	1 oz.	1,000 c.c.s.

Mix in equal parts, keep in the dark, and filter just before use.

The sensitiser is applied with a brush or sponge. The paper is printed until the shadows bronze, and is "developed" simply by soaking in one or two changes of plain water.

Solution for Writing Titles on, removing blue lines from, blue prints, etc.—Potass. oxalate, 75 grs. per oz.; 170 gms. per 1,000 c.c.s.

Brightening the Colour.—Blue prints are improved in colour by a final bath of 2½ per cent. alum solution, 3 per cent. oxalic acid, or 1 per cent. hydrochloric acid.

The Kallitype Process.

Paper, sensitized as below, is printed to a semi-visible image, like platinum paper. It yields prints from black to sepia, according to the developer. If prints are fixed in a mixture of hypo and ammonia, the results appear to be permanent.

* If the ordinary brown citrate be used, the formula should contain 80 grs. (188 gms.), and the ferricyanide should be increased to 60 grs. (137 gms.).

SENSITISER.

Ferric oxalate	.. .. ..	75 grs.	170 gms.
Silver nitrate	.. .. ..	30 grs.	70 gms.
Distilled water	.. .. ..	1 oz.	1,000 c.c.s.

The ferric oxalate is shaken up with the hot water and a grain or two of oxalic acid added to get it into solution. After filtering the silver is added and the solution stored in the dark.

Paper thus sensitised yields prints of full gradation and half-tone from ordinary negatives, such as print well in P.O.P. For flat negatives further bichromate solution may be used in the developer.

DEVELOPERS.

For Black Tones.

Borax	.. ..	2 ozs.	100 gms.
Rochelle salt	.. .. ..	1½ ozs.	75 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1%)	..	15–18 drs.	90-115 c.c.s.

For Purple Tones.

Borax	.. ..	½ oz.	28 gms.
Rochelle salt	.. .. ..	2 ozs.	100 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1%)	..	15–18 drs.	90–115 c.c.s.

For Sepia Tones.

Rochelle salt	.. .. ..	1 oz.	50 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1 %)	..	8–10 drs.	50 60 c.c.s.

Prints are allowed to remain in either of the above developers for from 15 to 30 minutes.

For Black Tones.

Sodium acetate	.. .. ..	3 ozs.	150 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

From this developer prints must be passed into a bath of potass. oxalate (15 %) before fixing.

FIXING SOLUTION.

Hypo	.. ..	1 oz.	200 gms.
Ammonia (0·880)	.. .. ..	120 minims	12 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

Prints are left in this for at least 10 minutes.

Sepia Paper.

This process and the single-solution sensitiser given below may be used for printing from ordinary negatives, but the results are deficient in gradation. Both are excellent for making duplicates of plans, etc., and give a copy in white lines on a brown ground from an ordinary tracing. This copy may be used as a negative for preparing further "positive" copies.

A.—Ferric ammonia citrate (green)	..	110 grs.	250 gms.
Water	..	1 oz.	1,000 c.c.s.
B.—Tartaric acid	..	18 grs.	40 gms.
Water	..	1 oz.	1,000 c.c.s.
C.—Silver nitrate	..	45 grs.	100 gms.
Water	..	1 oz.	1,000 c.c.s.
D.—Gelatine	..	30 grs.	70 gms.
Water	..	1 oz.	1,000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time. The prints are fixed in 1: 50 hypo.

One-Solution Sepia Sensitiser.

Silver nitrate	..	55 grs.	3·5 gms.
Water	..	4-5 drs.	15-20 c.c.s.

Add ammonia drop by drop just to redissolve the white precipitate, and then a little sulphuric (or citric) acid just to remove the odour of ammonia. Then add—

Ferric ammonium citrate (green)		40 grs.	2 5 gms.
Water	..	6 drs.	25 c.c.s.

This solution keeps in the dark, and is used like the four-solution mixture.

Pellet Process.

The Pellet process is for copies of line drawings only From an ordinary tracing it gives a copy in blue lines on a white ground.

A.—Pure gum arabic	..	4 ozs.	200 gms.
Water	..	20 ozs.	1,000 c.c.s.
B.—Ferric ammonium citrate	..	10 ozs.	500 gms.
Water	..	20 ozs.	1,000 c.c.s.
C.—Ferric chloride (crystallised)	..	10 ozs.	500 gms.
Water	..	20 ozs.	1,000 c.c.s.

Add 8 vols. of B, then 5 vols. of C to 20 vols. of A, in small doses with constant stirring.

The prints are developed on 10 per cent. solution of potass. ferrocyanide and "fixed" in 1 : 25 sulphuric acid (specific gravity 1·98).

The Ferro-Gallic Process.

This process is for line drawings only. It gives a copy, in bluish-black lines on a white ground, from an ordinary tracing.

Gum arabic	..	60 grs.	135 gms.
Warm water	..	1 oz.	1,000 c.c.s.

When dissolved add the following in the order given:—

Tartaric acid	..	8 grs.	18 gms.
Salt	..	36 grs.	81 gms.
Ferric sulphate	..	40 grs.	90 gms.
Ferric chloride	..	60 grs.	135 gms.

The developer for the prints is:—Alum and gallic acid, 1 part of each; water, 80 parts.

MOUNTANTS.

Starch Paste.

Pure starch is mixed with a very small proportion of cold water to form a very stiff mass. It should be so stiff that it is stirred with difficulty. Perfectly boiling water is then poured in, about 12 ozs. for every ounce of starch. On stirring, the mixture will jellify without being boiled; but if it does not it is brought to the boil, cooled, the skin taken off, and the paste used on day of making.

Gelatine.

For mounting prints without cockling.

Nelson's No. 1 gelatine	4 ozs.	50 gms.
Water	16 ozs.	200 c.c.s.

Soften the gelatine in the water, liquefy on the water bath, and add a little at a time and stirring rapidly:—

Methylated spirit	5 ozs.	30 c.c.s.
Glycerine	1 oz.	6 c.c.s.

The mountant is used hot. A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

Dextrine Paste.

Dextrine, best white	2¾ lbs.
Water at 160° F.	80 ozs.
Oil of wintergreen	15 minims
Oil of cloves	15 minims

Place the water in a vessel standing in a larger vessel of water kept to within 1° of 160° F. Stir in the dextrine slowly, and when it has all dissolved add the two preservative oils, stirring all the time. Then allow to cool, pour into bottles, and cork. Put aside in a cool place for a week or two for the mixture to congeal to a firm white smooth paste.

Starch-Gelatine.

A.—Bermuda arrowroot	8 ozs.	200 gms.
Water	4 ozs.	100 c.c.s.
B.—Nelson's No. 1 soft gelatine ..	360 grs.	10 gms.
Water	64 ozs.	800 c.c.s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	5 ozs.	250 c.c.s.
Carbolic acid (liquid)	25 minims	3 c.c.s.

This is a good cold paste, which sticks and keeps fairly well.

Liquid Gelatine.

Gelatine	1 oz.	100 gms.
Water	6 ozs.	600 c.c.s
Chloral hydrate	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat, and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

Gum-Dextrine.

Picked white gum arabic ..	½ oz.	65 gms.
Dextrine	2¼ ozs.	280 gms.
Liquid ammonia	4 drops	50 c.c.s.
Carbolic acid	1 dr.	15 c.c.s.
Water	8 ozs.	1,000 c.c.s.

The gum is powdered in a mortar and mixed intimately with the dextrine, and rubbed with 2 ozs. of water until a smooth mixture is obtained. The remainder of the water is added, and the whole boiled for 10 minutes. The ammonia and carbolic acid are added when cold. This mountant keeps well for months, and is smooth in working and of great adhesiveness.

Shellac Mountant.

A strong solution of shellac in methylated spirit, or, better, rectified spirit, is thinly applied to both mount and print, and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums, etc.

Affixing Paper to Metal.

Tragacanth	3 ozs.	60 gms.
Gum arabic	12 ozs.	240 gms.
Water	50 ozs.	1,000 c.c.s.
or—		
Gum arabic	1 oz.	100 gms.
Aluminium sulphate	45 grs.	10 gms.
Water	10 ozs.	1,000 c.c.s

Mounting on Glass (Opalines).

Nelson's No. 2 soft gelatine ..	2 ozs.	30 gms.
Water	20 ozs.	300 c.c.s.

The gelatine is soaked in the water, and liquefied by standing the vessel in hot water. The solution is thinned down until nearly as thin as water. Print and glass are immersed, removed together, and squeegeed together with flat rubber squeegee.

WORKING UP, COLOURING, ETC., PRINTS.

Lubricant for Burnishing Prints.

Powdered Castile soap	20 grs.	5 gms.
Alcohol	10 ozs.	1,000 c.c.s.

Encaustic Paste.

Purified beeswax	50 parts
Oil of lavender..	30 parts
Benzole..	30 parts
Gum elemi	1 part

Baskett's Formula.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth and polish.

Preparing Prints for Colouring.

P.O.P.'s and Glossy Bromides.

Rub the prints lightly with a tuft of wool slightly moistened with artist's purified ox-gall. If they have been lubricated before burnishing apply previously a little alcohol in the same way.

Collodion Prints.

Fluid extract of quillaia	1 dr.	5 c.c s.
Water	1 oz.	40 c.c.s.
Alcohol	1 oz.	40 c.c.s.

Bromides.

For Water Colouring.

Apply ox-gall as directed for P.O.P., or prepare as directed below for pastel work.

For Oil Colouring.

If the surface is clean no preparation is needed ; if otherwise give a wash of gum, starch, or gelatine, or prepare with pumice powder. Also light drying oil (from the artists' colourman) may be rubbed over with a tuft of wool or the fingers. It dries in about twenty-four hours, and leaves the surface of the bromide ready for painting.

For working up in pastel or black and white, apply fine pumice powder with a tuft of wool, and *remove* with another piece of wool or a duster.

Fixatif for Crayon and Pastel Work.

A.—Mastic	24 grs.	1·6 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation, and allow to stand some hours before use.

B.—Celluloid (film clippings free from emulsion will do)	7 grs.	0·45 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation. Mix when both are clear, and keep in tightly-corked bottle. Apply with spray diffuser.

Colouring Prints with Dyes.

Dissolve the aniline colour (1d. packets of dye will do) in a sufficient quantity of water (from ½ to 1 oz. to a 1d. packet), and for glossy prints add a little gum. If the work affects the gloss when finished, rub the print over with a piece of wool slightly moistened with a solution of wax in benzole.

Colouring Prints with Artists' Water Colours.

The following are suitable colours for bromide enlargements, platinotypes, and carbon prints. The colours in ordinary type are permanent; those in italics are more or less doubtful except under special precautions against exposure. Those marked * are transparent.

*Alizarin Scarlet.
Flesh Tint, No. 1.
Flesh Tint, No. 2.
Flesh Tint, No. 3.
*Indian Red.
*Rose Madder.
Venetian Red.
Vermilion.
*Antwerp Blue.
Cobalt Blue.
*French Ultramarine.
Indigo.
*Prussian Blue.
*_Brown Pink._
*Burnt Sienna.
Cadmium Yellow.
Chrome Lemon.
Chrome Orange.
*Indian Yellow.
Naples Yellow.
*Raw Sienna.
Roman Ochre.
Yellow Ochre.
Emerald Green.
*_Hooker's Green, No2._
Terre Verte.
*_Brown Madder._
Payne's Grey.
Raw Umber.
Sepia.
*_Vandyke Brown._
Ivory Black.
Lamp Black.
Chinese White.

Colours for Air-brush Work.

The following is a list of the most useful colours for air-brush work:—

Blanc d'Argent, No. 2.
Burnt Sienna.
Burnt Umber.
Charcoal Grey.
Chinese White.
Chrome Lemon.
Chrome Yellow.
Chrome Deep.
Chrome Orange.
Cologne Earth.
Emerald Green.
Indian Red.
Lamp Black.
Light Red.
Mauve.
Naples Yellow.
Neutral Tint.
Permanent Crimson.
Permanent Green.
Permanent Scarlet.
Prussian Blue.
Raw Sienna.
Raw Umber.
Ultramarine, Light.
,, Middle.
,, Deep.
Vandyke Brown.
Vermilion.
Yellow Ochre.
Brown Madder.
Emerald Oxide of Chromium
Indian Yellow.
Sepia.

Spotting Bromide Prints.

Mix together Payne's grey and Indian ink (the colour should match that of the film).

Spotting P.O.P. Prints.

Add a little carmine to the above. When mixture is dry (on the palette) work in a strong solution of gum, rubbing the brush one way only, to avoid making air-bells. If the prints are to be enamelled or glazed by stripping after spotting, then artists' oil colours with benzole in which gum dammar has been dissolved, or water colours, may be used with shellac water varnish. (See "Negative Varnishes.")

Colouring from Behind (Crystoleum).

The print (which should be albumen) is mounted with a warm solution of:—

Hard gelatine	20 grs.	45 gms.
Water	1 oz	1,000 c.c.s.

containing a little salicylic acid to keep it. Or with a cold mountant made by mixing the above with an equal volume of starch paste.

VARNISH FOR "TRANSLUCING."

Canada balsam	5 ozs.	100 gms.
Solid paraffin	2 ozs.	40 gms.
White wax	2 ozs.	40 gms.

which is melted, the picture immersed, and the whole kept as cool as possible consistent with remaining fluid.

COLOUR PHOTOGRAPHY.

The following are the official working instructions for the screen-plates freely in the market at the time of sending this portion of the Almanac to press (September 15, 1913):—

The Autochrome Plate.

SIMPLIFIED METHOD OF DEVELOPMENT.

Two solutions only are used—developer (used also for re-development) and reversing solution. There is no need to fix.

Developer—Stock Solution.

A.—Water, distilled..................	35 ozs.	1,000 c.c.s.
Metoquinone (Quinomet)	½ oz.	15 gms.
Soda sulphite, anhydrous	3½ ozs.	100 gms.
Liquor ammonia, ·920	9 drams	32 c.c.s.
Potass. bromide	90 grs.	6 gms.

Dissolve the Quinomet in warm water (about 100° F.), add the sulphite, and then, when cold, the ammonia.

Working developer : Stock solution, above, 1 part; water, 4 parts. For correct exposure, time of development is 2½ minutes exactly; then rinse and immerse in reversing solution, C, below.

Where exposure may not be correct, it is best to develop by the following table, allowing of errors being compensated for :—

For half-plate, place in developing dish.

C.D.—Stock solution, A. above..........	85 minims	5 c.c.s.
Water	2½ ozs.	80 c.c.s.

Have ready in one measure-glass :—

Stock solution, A. above..........	½ oz.	15 c.c.s.

and in another.—

Stock solution, A. above..........	1½ ozs.	45 c.c.s.

These are placed near the lamp, one or the other quantity of the developer being quickly added to that in the dish, according as the plate comes up quickly or slowly.

Immerse the plate in solution CD, and count the number of seconds elapsing before the first outlines of the image appear (disregarding the sky) by looking at the plate rapidly without taking it out of the dish. Immediately these outlines are discernible, pour into the dish either 15 c.c.s. (½ oz.), or 45 c.c.s. (1½ oz.) of A, whichever may be necessary according to the following table, continuing to count the seconds :—

Appearance of outlines of image (disregarding sky) after immersion		Quantity of developer A to add on appearance of first outlines	Total duration of development from immersion of plate	
	Seconds		Minutes	Seconds
	12 to 14	15 c.c.s. (½ oz.)	1	15
	15 to 17	do. do.	1	45
	18 to 21	do. do.	2	15
	22 to 27	do. do.	3	0
	28 to 33	do. do.	3	30
	34 to 39	do. do.	4	30
Extreme under-exposure	40 to 47	45 c.c. (1½ ozs.)	3	0
Extreme under-exposure	Above 47	45 c.c. (1½ ozs.)	4	0

For a quarter-plate use one-half the above quantities.

REVERSING SOLUTION.

C.	Potass. permanganate............	30 grs.	2 gms.
	Sulphuric acid	3 drams.	10 c.c.s.
	Water	35 ozs.	1,000 c.c.s.

This solution will keep for a short time, but should not be used if cloudy.

Immediately the plate is covered by the C solution daylight may be used. After 3 or 4 minutes wash for 30 seconds in running water.

In summer it is well to put the plate, after leaving the C bath, for 2 minutes into a solution of chrome alum, as follows:—

Chrome alum	150 grs.	10 gms.
Water	35 ozs.	1,000 c.c.s.

The plate should be rinsed before placing in the second developer, or, if desired, it may be dried and re-developed after a day or two.

Second Development.—The plate is then re-developed in full daylight, using the solution which has served for the first development (kept in the dish without special precautions). When the highlights are completely darkened (about 3 or 4 minutes) the plate is washed for 3 or 4 minutes, and immediately placed to dry. Fixing is unnecessary unless the plate is intensified.

PYRO DEVELOPMENT.

The following method, which was that originally advised for the development of Autochrome plates, is still preferred by some workers. The solutions are as follows:

First Development.

A.A.	—Water	$3\frac{1}{2}$ ozs.	100 c.c s.
	Soda bisulphite solution	2 drops	2 drops
	Pyro	45 grs.	3 gms.
	Potass bromide	45 grs.	3 gms.
B.B.	—Water	3 ozs.	85 c.c.s.
	Soda sulphite, anhydrous	3 drams.	10 gms.
	Ammonia ·920	$\frac{1}{2}$ oz.	15 c.c.s.
	Working developer:—		
	Water	$3\frac{1}{2}$ ozs.	100 c c.s.
	A.A.	3 drams.	10 c.c.s.
	B.B.	3 drams	10 c.c.s.

This developer serves for once only. Time of development (for correct exposure), $2\frac{1}{2}$ minutes exactly at 60° to 65° F.

Reversing Bath.

C.—As given above, and used as there directed.

Second Development.

D.—Water, distilled	35 ozs.	1,000 c.c.s.
Soda sulphite, anhydrous	$\frac{1}{2}$ oz.	15 gms.
Dianol (Diamidophenol)	75 grs.	5 gms.

After a rapid washing, the plate is placed in the Dianol (Diamidophenol) developer D for 3 or 4 minutes. This should be performed in a strong light, and continued until the white portions are completely blackened. Over-development need not be feared.

There is no need for fixing the plate after the second development. It only requires washing, drying, and varnishing.

CONTROLLED DEVELOPMENT WITH PYRO.

Make a quarter-strength pyro solution, viz. :—

bb	Solution B.B.	1 part
	Water	**3 parts**

To make working developer for a half-plate take:—

Solution A.A.	3 drams.	10 c.c.s.
Solution *b.b.*	3 drams.	10 c.c.s.
Water	3 ozs.	80 c.c.s.

And have ready in a small graduated measure $1\frac{1}{2}$ oz. (45 c.c.s.) of *b.b.* solution, to be added wholly or partly to the bath during development, if necessary.

As soon as the plate is in the dish, count the number of seconds from the moment of entering until the appearance of the first outlines of the image. The sky, however, should not be taken into consideration.

It is unnecessary to view the plate by the light of the lantern until 20 seconds have elapsed, as whatever be the degree of exposure the first forms will not be seen before 22 seconds.

The number of seconds elapsing before the appearance of the image is the guide to the further development of the plate, which should be carried out according to the following table :—

Time of first appearance of image (not counting sky).	Quantity of ammonia solution *bb*, *i.e.*, diluted to quarter strength, to be added after image appears.	Total time of development, including time of appearance.	
Seconds.	C.c.s.	Minutes	Seconds
22 to 24	None	2	0
25 to 27	2	2	15
28 to 30	8	2	30
31 to 35	15	2	30
36 to 41	20	2	30
42 to 48	25	2	30
49 to 55	30	2	45
56 to 64	35	3	0
65 to 75	40	4	0
over 75	45	5	0

The additional quantity of *bb* solution must be added when the outlines begin to appear.

We see by the above that, for example, when the image takes 28 seconds to appear we add 8 c.c.s. of *bb* solution and continue development until the expiration of 2 minutes 30 seconds from the time the plate was put in the dish.

INTENSIFICATION.

If, after the second development, the plate does not show sufficient contrast and brilliancy, it may be much improved by intensification.

This operation may take place at the time of development or be delayed, if desired, till a later time.

Whichever plan is followed, all traces of the developer must be first destroyed by the following operation :—

Oxidation.

Immerse the plate for 10 or 15 seconds (after a wash of similar duration) in solution E, composed of :—

E.	Water	35 ozs.	1,000 c.c.s
	Solution C (Acid Permanganate)	5 drams	20 c.c.s.

which oxidises any traces of developer remaining in the coating, and allows proper intensification. Then wash the plate for a few seconds in running water.

For intensification prepare the two following solutions :—

F.	Distilled water	35 ozs.	1,000 c.c.s.
	Pyrogallic acid	45 grs.	3 gms.
	Citric acid	45 grs.	3 gms.
G.	Distilled water	3½ ozs.	100 c c.s.
	Nitrate of silver	75 grs.	5 gms.

For use take :—

Solution F	3½ ozs.	100 c.c.s.
Solution G	3 drams	10 c.c.s.

Immerse the plate in this solution and examine from time to time the increase of intensity. The solution turns yellow little by little, and eventually becomes turbid. It should be used as quickly as possible, and rejected when turbidity makes its appearance.

Usually intensification is complete before this state is reached, but should it be necessary to continue intensification, fresh solution should be used after a short wash, a few seconds in the oxidizing solution (E), and another short wash.

During intensification the whites of the plate may become yellowish (dichroic fog). All traces of this disappear in the following clearing bath.

Clearing.

After intensification, wash the plate for a few seconds and place in the following solution (H) of permanganate, containing no acid. Allow this to act from 30 seconds to 1 minute :—

H.	Water	35 ozs.	1,000 c.c.s.
	Potass. permanganate	15 grs.	1 gm.

Particular care should be exercised that Solution C (Acid permanganate) be not mistaken for Solution H (Neutral permanganate).

Fixing.

After a short wash, fix for about 2 minutes in an acid hyposulphite bath made as follows :—

I.	Water	35 ozs.	1,000 c.c.s.
	Hypo.	5¼ ozs.	150 gms.
	Soda bisulphite, saturated solution	1¾ ozs.	50 c.c.s.

The density of the image should not be reduced by fixing. Should reduction be found, it is caused either by too short second development or exposure to too weak a light during second development. Fixing is indispensable when the plate has been intensified.

WASHING.

A wash for 4 to 5 minutes is sufficient to clear the extremely thin gelatine coating of traces of hyposulphite. The plate is then put to dry. It may be that the whites of the subject still retain a slight yellowish tinge. If so, treatment by Neutral Permanganate (solution II) followed by use of the fixing bath I may be repeated.

The Omnicolore Plate.

The instructions and formulæ are those given above for the Autochrome, the same emulsion being used for both plates.

The Dufay (Dioptichrome) Plate.

FIRST DEVELOPMENT.

The following developer is recommended to the exclusion of all other formulæ:—

Water	35 ozs.	1,000 c.c.s.
Metol	90 grs.	6 gms.
Sulphite of soda recrystallised	2½ ozs.	75 gms.
Hydroquinine	30 grs.	2 gms.
Potass. bromide	30 grs.	2 gms.
Ammonia ·880	3½ drams	12 c.c.s.

(Ammonia at ·880 being volatile and liable to loss, it is a convenient practice to dilute it on receipt with an equal bulk of distilled water, and then use double the quantity indicated above.)

For use take equal parts of the above developer and of water. This developer is adapted for automatic development, giving images with full detail and the maximum of intensity. The time of development at 60 F. should be 4 to 5 minutes. Fresh solution should be taken for each plate developed. The development should be begun in as nearly complete obscurity as possible. In about a minute after immersion in the developer it is permissible to examine the plate by a green safe light. Red light is in no case to be used, and it is advisable to expose the plates to the green light as little as possible. When the image is sufficiently developed, wash for about 20 seconds in running water, then place in the reversing solution.

REVERSING SOLUTION.

Water	35 ozs.	1,000 c.c.s.
Potass. bichromate	75 grs.	5 gms.
Sulphuric acid	170 minims	10 c.c.s.

Immediately the plate is covered with this solution admit daylight to the dark room or take the dish to an open door or well-lit window, as the rest of the operations should take place in full daylight. The reduced silver will gradually dissolve in the bichromate solution; the progress of the reversal and the appearance of the real colours may be seen on looking through the plate. When the

reversal is complete, which occupies about two minutes, wash in running water till the yellow stain, due to the bichromate, disappears.

SECOND DEVELOPMENT.

Then commence the second development by replacing the plate in the developer previously used for the first development. The image when it left the reversing solution consisted of a positive image in white silver bromide, which is reduced to a black deposit of silver by the action of the developer and daylight, or, failing that, of strong artificial light. The second development should be continued till the darkening action is complete, which will be in about 3 or 4 minutes in daylight.

FINAL WASHING.

Three or four minutes' washing in running water is sufficient although a longer time is not harmful.

INTENSIFICATION.

If over-exposed, the image appears too quickly on the first development, the ultimate result being a thin image with a washed-out appearance. This result may be improved to a certain extent by intensification. Bleach thoroughly in :—

Water	20 ozs.	800 c.c.s.
Alcohol	5 ozs.	200 c.c.s.
Bichloride of mercury............	1 oz.	40 gms.

Then wash for 5 minutes and blacken in the following solution :—

Water	10 ozs.	100 c.c.s.
Soda sulphite, recryst.	1 oz.	10 gms.

The Paget Plate.

DUPLICATING METHOD.

A separate panchromatic plate is exposed behind and in contact with a mosaic three-colour taking screen, developed, fixed, washed and dried. From it a positive transparency is printed by contact The transparency is then bound up in register with a mosaic three-colour viewing screen.

EXPOSURE.

The following particulars are given as a rough guide.

Open landscape, in good light with sunshine, stop *f*/8, cap off and on, or about ½ of a second.

Portraiture, head and shoulders only; in diffused light out of doors, stop *f*/8, about 3 seconds.

Instantaneous exposures should not be attempted except in the brightest light, and never with a smaller stop than *f*/6·5, under which conditions the exposure may be about $\frac{1}{10}$th of a second.

Actinometers are a reliable means of calculating the exposure, and the following speed numbers will be found correct :—

Watkins	Wynne
15	F24

These numbers represent the speed of the panchromatic plate with filter and taking screen in position ready for exposure.

Development of Negative.

Most developers may be used, provided the resulting negative be clean and soft. The best results are obtained with Rodinal, 1 in 30, and development should be complete in 2 minutes.

Unless a green safelight is used development must take place in total darkness. On no account should a red light or one of any colour other than the safe green be used. Development in total darkness presents no difficulty, as if the exposure given is about right, the time of development with Rodinal as given above will be correct.

Rinse the plate and fix in the following bath:—

Hypo	6 ozs.
Potass. metabisulphite	½ oz.
Water	20 ozs.

Wash again for about 15 minutes, and put to dry.

Making the Transparency.

To obtain the best results the following conditions must be observed:—The transparency should be of black tone, perfectly clear, and free from fog, brilliant and full of detail. These conditions can be secured by using the special transparency plates and developer issued in connection with the process.

Registering Transparency with Viewing Screen.

Standing well back in the room, facing the light, the operator holds the two plates together, film to film, the screen being towards him. The latter is then moved very slightly in a circular direction (the transparency being held rigid) until small squares are seen. The same circular direction being maintained the squares will grow larger until they disappear and patches of colour take their place. Continue the movement until a perfectly even tint (it does not matter of what colour) appears all over the transparency. The squares of the screen are now parallel with those of the transparency, and the slightest movement of the screen one way will give the picture in its correct colours. To determine the right direction the operator, still holding the screen and transparency tightly together, should turn them in a slanting position, viewing them from either the top, bottom, right or left, when from one of these points the correct colours will be seen. The screen should be moved very gently in this direction, when the proper colours will gradually appear. Clip the two together with a couple of bull-dog paper clips and bind them securely.

Binding must be carefully done, so as not to alter the position of the screen. Denison's binding strips will be found the best. Bind the two sides not clipped and see that the binding strip is adhering everywhere; then remove one clip at a time (the transparency should never be without one clip) and clip the sides already bound before binding the remaining two. Leave the clips in position until the binding is perfectly dry.

The viewing screens will register one way only, always the lengthways of the plate. Therefore, if it is desired to take a portion of the picture from a large negative, say a quarter plate size from a half plate

negative, the quarter plate transparency must be made the lengthways of the negative and not across.

In the case of square cut plates such as $3\frac{1}{4} \times 3\frac{1}{4}$ a line will be found on the edge of the viewing screen showing the "lengthways" of the plate.

MISCELLANEOUS FORMULÆ.

Reversed Negatives by Ammonium Persulphate.

A lantern or other thinly coated slow plate is placed in contact with the negative in a printing frame and a full exposure given such as would be thought advisable in making a soft positive transparency. The plate is developed with a clean working developer (*e.g.*, glycin) until the shadows appear quite black on the glass side of the plate. The time of development may be five times as long as for an ordinary transparency. The latter is then washed and placed in a 2 per cent. solution of ammonium persulphate until the silver image is seen to be removed. The plate is then thoroughly washed and developed in any clean developer containing about half a grain of bromide per ounce. It is then fixed and washed and dried. After the first development the operations may be done in weak daylight or artificial light. The action of the persulphate should be as complete as possible, otherwise a veil is left over the negative. The above is a very rapid and economical process. Direct positives, but reversed from right to left, from engravings, etc., may be made in the camera by substituting bromide paper for the plate. The exposure should be full and the development as above. The method has this advantage, that the lines are rendered in the same degrees of black and grey as in the original, a point of some importance, since the lines in an engraving are seldom, if ever, of uniform blackness.

To Recover Fogged (Sensitive) Dry-Plates.

Potass. bichromate	..	100 to 200 grs.	11 to 22 gms.
Hydrochloric acid	..	30 minims	3 5 c.c.s.
Water	..	20 ozs.	1,000 c.c.s.

Bathe the sensitive plates in above for two minutes, wash for one or two minutes in running water, and dry—all in the dark or by ruby light, of course. Solution slows plates, and may be used, as above or after exposure, to obtain contrast on extra-rapid plates—*e.g.*, when copying black and white or other subjects.

Backing Dry Plates.

Gum solution (ordinary office gum)	1 oz.	100 c.c.s.
Caramel	1 oz.	100 gms.
Burnt sienna, ground in water	2 ozs.	200 gms.

Mix and add—

Alcohol	2 ozs. (fl.)	200 c.c.s.

Backing Sheets for Dry Plates.

Gelatine	1 part	50 gms.
Water	2 parts	100 c.c.s.
Glycerine	1 part	50 c.c.s.
Indian ink	A small addition.	

Make a paste, and coat strong paper; place the prepared material face downwards on waxed glass to set. Press to back of plate before putting into dark slide.

The Dusting-on Process.

Best gum arabic	80 grs.	5·2 gms.
White sugar	60 grs.	4·0 gms.
Ammonium bichromate	60 grs.	4·0 gms.
Water	7 ozs.	200 c.c.s.
Methylated spirit	1 oz.	30 c.c.s.

This mixture will keep for a few days only, and after the plate has been coated and exposed it is developed with finest graphite powder, collodionised, and washed.

Ink for Rubber Stamps.

Aniline red (violet)	900 grs.	210 gms.
Boiling distilled water .. .	10 oz.	1,000 c.c.s.
Glycerine .. .. .. about	½ oz.	60 c.c.s.
Treacle .. .. .. about	¼ oz.	30 c.c.s.

Invisible Ink.

Chloride of cobalt	25 grs.	60 gms.
Distilled water	1 oz. (fl.)	1,000 c.c.s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming the writing turns blue.

Dead Black for Wood.

Borax	30 grs.	8 gms.
Glycerine	30 minims	8 c.c.s.
Shellac	60 grs.	16 gms.
Water	8 ozs.	1,000 c.c.s.

Boil till dissolved and add—

Nigrosine, W.S.	60 grs.	16 gms.

Or paint the wood first with—

Cupric chloride	75 grs.	75 gms.
Potassium bichromate	75 grs.	75 gms.
Water	2¼ ozs.	1,000 c.c.s.

and as soon as the surface dries apply—

Aniline hydrochlorate	150 grs.	150 gms.
Water	2¼ ozs.	1,000 c.c.s.

and wipe off any yellow powder that forms. Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterproofing Solution for Wood.

Asphalt	4 ozs.	400 gms.
Pure rubber	30 grs.	6 gms.
Mineral naphtha	10 ozs.	1,000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil..	20 ozs.	400 c.c.s.
Spirits of camphor	2 ozs.	40 c.c.s.
Vinegar	4 ozs.	80 c.c.s.
Butter of antimony	1 oz,	20 gms
Liquid ammonia	¼ oz.	5 c.c.s.
Water	¼ oz.	5 c.c.s.

This mixture is applied very sparingly with a bit of old flannel, and thoroughly rubbed off with soft rags.

Blackening Brass Work.

Copper nitrate	200 grs.	450 gms.
Water	1 oz.	1,000 c.c.s.

Place the brass work (perfectly cleaned) in the solution for a few moments, heating it on removal.

Varnish for Brass Work.

Celluloid	10 grs.	4 gms.
Amyl alcohol	½ oz.	100 c.c.s.
Acetone	½ oz.	100 c.c.s.

Instead of this cold celluloid varnish, commercial "cold lacquer' can be used.

To Blacken Aluminium.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in—

Ferrous sulphate	1 oz.	80 gms.
White arsenic	1 oz.	80 gms.
Hydrochloric acid	12 ozs.	1,000 c.c.s.
Dissolve and add—		
Water	12 ozs.	1,000 c.c.s.

When the colour is deep enough dry off with fine sawdust, and lacquer.

Silvering Mirrors (Martin's Method).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.*)

A.—Nitrate of silver	175 grs.	40 gms.
Distilled water	10 ozs.	1,000 c.c s.
B.—Nitrate of ammonium	262 grs.	60 gms.
Distilled water	10 ozs.	1,000 c.c.s.
C.—*Pure* caustic potash	1 oz.	100 gms.
Distilled water	10 ozs.	1,000 c.c.s.
D.—Pure sugar candy	½ oz. (avoir.)	100 gms.
Distilled water	5 ozs.	1,000 c.c.s.
Dissolve and add—		
Tartaric acid	50 grs.	23 gms.
Boil in flask for ten minutes, and when cool add—		
Alcohol	1 oz.	200 c.c.s.
Distilled water, *quant. suff.* to make up	to 10 ozs.	or 2,000 c.c.s

For use take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downwards in the solution.

A GLOSSARY OF PHOTO-GRAPHIC TERMS.

ABRASION MARK.—Scummy appearance or black lines on a bromide or gaslight print caused by sensitive paper being rubbed against negative or other sheets of paper.

ACCELERATOR.—Usually the alkali, in a developer, which hastens development and tends to fog.

ACHROMATIC, applied to a lens, means that it renders sharply on the plate the image which is focussed sharply on the ground-glass focussing screen.

ACID FIXING BATH does not mean a hypo bath mixed with any acid, but only with the particular acid, sulphurous or equivalents of it, *e.g.*, soda bisulphite, potass metabisulphite and soda sulphite with an acid, such as sulphuric or citric.

ACTINIC, applied to light, means the kind which affects photographic plates and papers, usually blue and violet rays; but all rays are "actinic" now that plates are so highly colour-sensitive.

ACTINOMETER.—An instrument for gauging the strength of light by an observation of the time taken for a sensitive paper to darken to standard tint.

AERIAL PERSPECTIVE.—The effect (softening down in tone, colour and detail) of distance upon objects in a landscape.

AEROGRAPH.—A trade name for air-brush, which is an appliance for distributing colour as a fine spray by means of compressed air.

AIR-BELLS.—Minute bubbles of air which cling to a plate in development and lead to white or light spots on the negative.

ALBUMENIZED PAPER. A printing paper (now almost obsolete) in which the sensitive silver salt was held in albumen (white of egg).

ALKALI.—Opposite to acid. Alkalies are substances which neutralise acids. They are used chiefly as energisers of developers, forming the "accelerator" or, usually, No. 2 solution. The chief are caustic potash and soda, soda and potass carbonate, and ammonia.

ALKALINE, applied to a solution, means that it has had alkali added to it in excess of any acid in it.

ANACHROMATIC, applied to a lens, means one which does not give a sharp negative when the subject has been focussed sharply. Such lenses are used for their softness of definition.

ANASTIGMAT.—A lens free from astigmatism, that is, from the defect of failing to render sharply both horizontal and vertical lines at the same time.

ANGLE OF VIEW is the greatest angle covered by a lens, viz., the angle included between the two lines drawn (usually) from the stop to the edges (or ends of the diagonal) of the plate.

ANHYDROUS = without water. Describes salts such as soda sulphite, soda carbonate, hypo, etc., when sold with the water of crystallisation removed. The "strongest" form of such chemicals.

APLANAT.—A lens both achromatic and free from spherical aberration, and at the same time working at a fairly large aperture, *e.g.*, *f*/8. Most R.R.'s are aplanats.

APOCHROMATIC = extra-achromatic, as it means lenses in which red as well as yellow and violet rays come to the same focus. Such lenses are specially suited for colour photography and three-colour block-making.

ARISTOTYPE.—The original name for P.O P. when introduced in Germany, coated with collodion emulsion: now applied both to collodion and gelatine papers.

ASTIGMATISM.—See Anastigmat.

AUTOTYPE PROCESS.—In England means carbon printing; in Germany, half-tone photo-engraving.

BACK FOCUS.—The distance from the back surface of the lens to the focussing screen when a distant object is focussed. Indicates only the camera extension required for a given lens.

BACKING.—Material, black or red, applied to the glass side of a plate as an absorbent of light and preventive of spread of light in the negative as the result of reflection of light from the glass. Sometimes placed (in manufacture) between glass and emulsion.

BARYTA (barium sulphate) is the material applied as a coating to raw paper before coating with sensitive emulsion. Protects the latter from impurities in the paper.

BLISTERS.—Bubbles formed between the film and the plate or paper support. Due to too strong solutions, differences of temperature, etc.

BLOCKING OUT.—Painting over, on a negative, all but a particular part by means of opaque pigment or strongly coloured dye. Done on either film or glass side.

BOLTING CLOTH OR SILK.—Fine meshed material used for obtaining diffused definition in enlargements by inserting it (stretched on a frame) between lens and sensitive paper.

B.P. = British Pharmacopœia. Indicates a standard of strength and purity adopted by pharmacists.

BROMIDE PAPER.—Paper coated with a rapid emulsion: the invisible image, produced by exposure through a negative or in an enlarger, is developed.

BROMOIL.—A print produced by bleaching a bromide print and restoring the image by applying pigment with a brush.

BRONZING.—Metallic appearance of shadows of a print due to over-printing.

BURNISHING.—Producing a glossy surface by pressing prints through heated rollers.

CALCIUM TUBE.— An air-tight receptacle containing calcium chloride which strongly absorbs moisture and so keeps paper, etc., stored in the tube, perfectly dry.

CARBON PROCESS.—The method of making prints, the images of which consist of actual colour pigment. These are produced by exposing to light a mixture of gelatine, pigment, and potass bichromate. The gelatine becomes insoluble where light acts on it and so fixes the pigment.

CASKET LENSES.—Sets of lenses of different focal lengths, one such casket serving to form a considerable number of single and doublet lenses.

C.C.—collodio-chloride printing paper.

c.c. = cubic centimetre = about 17 minims.

C. DE V.—Carte de visite—an early size—$3\frac{1}{2}$ ins. × $2\frac{1}{4}$ ins.—of portrait photographs.

CHALKY.—Applied to negatives or prints which show excessive contrasts, i.e., are too much like a black and white drawing.

CHANGING BAG.—A bag of opaque material in which plates may be removed from or loaded into dark slides.

CHANGING BOX.—An attachment for the camera, holding, usually, 12 plates, which can be exposed in turn.

CHEMICAL FOCUS.—A lens is said to have a "chemical focus" when the image, obtained sharp on the focussing screen, is not sharp on the negative.

CHROMATIC ABERRATION.—The defect of a lens which renders it non-achromatic.—See Achromatic.

CIRCLE OF CONFUSION.—The permissible size of disc (in the image formed by a lens) which should be a point only. $\frac{1}{100}$ or $\frac{1}{200}$ of an inch (diameter) is arbitrarily adopted, but conditions may require a smaller "disc of confusion."

CLEARING SOLUTIONS.—Those which remove stain from negatives or prints without touching the image proper.

COLLODION.—A solution of nitro-cellulose in a mixture of alcohol and ether. Used as a means of holding sensitive silver salts in suspension for coating on paper, etc.; also for enamelling prints.

COLLODION, WET.—See Wet Collodion.

COLOUR SCREEN = light-filter, which see.

COLOUR-SENSITIZER.—A dye or dye solution which renders dry-plates sensitive to rays such as yellow, green and red in addition to the blue to which untreated plates are chiefly sensitive.

COMBINED BATH.—A mixture which both tones and fixes prints on print-out-paper.

CONDENSER.—A lens which collects rays from a source of light to a small concentrated beam which will thus pass through a small opening, e.g., the lens of an enlarger or lantern.

CONJUGATE FOCI.—The distances from object to lens and from lens to image when photographing any object. Their actual length is determined by the focal length of the lens; their relative length, by the scale upon which an object is being copied.

CONVERTIBLE LENS.—One in which the separate component glasses can be used as separate lenses.

CONTRASTY.—Applied to prints with very dark shadows and white high-lights, due to under-exposure or over-development of the negative.

C.P.—Applied to chemicals denotes "chemically pure." Applied to lights means "candle power."

CRYSTOLEUM.—A photograph coloured by first rendering it semi-transparent and then applying colours to the back. Comparatively crude colouring yields delicate effects owing to the interposition of the photograph.

CURVATURE OF FIELD.—The defect of a lens whereby the image of a flat subject is not flat but is formed on a saucer-shaped surface.

CUT-OUT MOUNT.—A mount consisting of a card in which is an aperture, usually with bevelled edges and a little smaller than the picture. It is fixed over the print, mounted on another card.

CUTTING SHAPE.—A plate, usually of glass, of the size to which a print is to be trimmed. It is laid on the print and a knife run round.

DAYLIGHT CHANGING.—Methods of bringing sensitive material into position for any number of exposures without recourse to a dark-room. Embodied almost exclusively in devices for films, *e.g.*, film-spools, film-packs.

DELIQUESCENT, *i.e.*, absorbing moisture from the air and becoming liquid.

DEFINITION.—Degree of sharpness, *i.e.*, distinctness of small detail.

DEPTH OF FIELD.—Rendering of both near and distant objects sharp on the one negative. Requires a small stop.

DEVELOPER.—Solution which brings up (renders visible) the invisible effect of light on a plate or paper.

DIFFUSED LIGHT.—That coming from the sun through light clouds, or, from source of artificial light, through ground glass, paper, etc,

DIFFUSION OF FOCUS (=soft definition).—Unsharpness due to bad lens, imperfect focussing.

DOUBLE EXPOSURE.—Applied to the accidental making of two full exposures on one plate ; also to making two photographs on different parts of the same plate by means of screens in front of the plate or on the lens hood.

DOUBLE EXTENSION.—Applied to a camera which allows of a distance between lens and focussing screen about double the focal length of the lens, *e.g.*, 20 inches in a half-plate camera.

DOUBLE IMAGE.—Duplication of the outlines of a photograph due to camera shaking at the time of exposure, or to subject moving : or, in a print, to the paper shifting during printing.

DOUBLE TONES.—One tone in the high-lights and another in the shadows, the bad result of, usually, an exhausted toning bath.

DOUBLE TRANSFER.—A form of the carbon printing process whereby reversal of the subject as regards right or left is avoided.

DOUBLET.—A lens of two separate components usually with the stop between, *e.g.*, a "rapid rectilinear."

DRY MOUNTING.—A method of mounting by means of thin tissue paper impregnated with shellac. This tissue is laid between print and mount, and on heat being applied fixes the two together.

EAU DE JAVELLE.—A mixture made by shaking together soda carbonate and chloride of lime and pouring off from the sediment. The active substance is hypochlorite, a remover of developer and other stains.

EMULSION.—A mixture (usually fluid when hot) holding a solid in a very finely divided state. Gelatine dry plates and papers are coated with an emulsion containing silver bromide or chloride suspended in gelatine solution. Such emulsions are fluid when warm and set firm when cold.

ENCAUSTIC PASTE.—A mixture of wax, varnish, etc., which is rubbed over the surfaces of prints, giving them a lustre.

EQUIVALENT FOCUS.=Focal length of lens, which see.

EURYSCOPE.—Applied to doublet lenses of somewhat larger aperture than rapid rectilinears usually *f*/6 as compared with *f*/8.

EVERSET SHUTTER.—One which is ready for a further exposure without re-setting.

EXPOSURE METER.—Strictly an instrument for finding the correct exposure for a plate by testing the strength of the light by means of a sensitive paper: used also for instruments which serve to calculate exposure from data of the sun's strength at the different times of day and year.

EXTRA-FOCAL DISTANCES.—The distance from lens to object and lens to plate (when photographing) in each case less the focal length of the lens. Their use greatly simplifies calculation.

F NUMBERS denote the "speed" of a lens. About the most rapid lens is *f*/3 to *f*/4·5: rapid, *f*/5·6 to *f*/6: medium, *f*/8 to *f*/11: slow (wide angle lenses) *f*/16 to *f*/22. The *f*/No is the number of times the diameter of the stop will divide into the focal length of the lens.

FACTORIAL DEVELOPMENT.—The system (of Watkins) of determining the full time of development, not by the appearance of the negative at the latest stage but by noticing the time taken for the image to appear and then continuing development for a multiple of this time. The multiple is the "factor."

FERRO-PRUSSIATE PROCESS.—A method of making prints of blue colour on paper sensitized with a ferric salt and potass ferricyanide. The printed-out image is "developed" and fixed in plain water only.

FERROTYPE PLATE.—Of thin metal, coated with polished enamel: for giving a high gloss to prints by drying them, film sides in contact with the plate.

FERROTYPE PROCESS.—A method of making positive portraits direct. A *whitish* image is developed on a dark enamelled iron plate coated with emulsion. The image (negative) thus supplies the light parts of the subject: the shadows are formed by the dark metal support.

FILM.—The coating of emulsion on a plate or paper: also the complete coated material consisting of emulsion on celluloid, *e.g.*, roll film, flat or cut film.

FIXED FOCUS.—Applied to a camera in which the lens is not moved to and fro for focussing objects at different distances. Implies the use of either a small stop in the lens or a lens of very short focus.

FIXING.—Amounts to "rendering permanent" and consists in removing the parts of a sensitive film left unaltered by exposure or development or both.

Flare Spot.—A patch, dark in the negative and light in the print, caused by a defect in the lens and occurring usually when a small stop is used and when strong light shines on the lens.

Flat.—Applied to negatives or prints and meaning lacking in contrast.

Flat Field.—Applied to a lens, which, when photographing a flat subject, *e.g.*, a painting, gives equal definition in all parts of the plate.

Focal Aperture.—The term for the speed of a lens. See F No.

Focal Length.—The distance of a lens from the focussing screen (the focus) when a very distant object (so distant that the rays from it are parallel when they reach the lens) is sharply rendered.

Focal Plane.—The flat surface in which lie the sharp images of a photographed scene or object. Thus the focal plane is, or should be, the focussing screen or plate.

Focal-plane Shutter.—A shutter of the roller-blind type placed as nearly in contact with the plate as possible.

Focus.—The *point* at which rays falling on a lens are brought together, but often used to denote focal length, see above.

Focussing Scale.—A graduated scale, the marks on which indicate the position in which the lens or camera front requires to be placed in order to render sharply objects at different distances.

Fog.—Deposit on a plate or print other than that produced by the image formed by the lens. May be caused by exposure to light, wrongly compounded developer, etc.

Forcing—in development. Treating under-exposed plates or prints by adding alkali or continuing development for a long time in order to get detail or density.

Frilling.—Separation (with cockling) of a film from its glass or paper support, caused by strong solutions alternating with weak or plain water; by differences of temperature; alkaline baths, etc.

Gaslight Papers.—Papers requiring to be developed, but of such sensitiveness that they can be printed by exposure to gaslight, yet developed by the same, placed at a greater distance.

Gum-Bichromate.—A printing process in which gum mixed with bichromate becomes insoluble (to a greater extent) where acted on by light: the non-affected parts are washed away.

Halation.—A spreading of light parts of the subject on to darker (in a photograph) due to reflection of light from the back of the plate or in the film itself at the time of the exposure.

Half-Tones.—Parts in a negative or print representing parts of the subject lighter than the shadows but darker than the high-lights.

Hardness.—In negatives and prints. Excessive contrast—chalkiness. Shadows portions, without detail in them, and lighter half-tones, too light.

Hypo-Alum Toning, that is with a heated mixture of alum and hypo in which bromide prints attain a purple brown hue.

Image.—Picture formed by the lens on the focussing screen. Also applied to the material of the picture on negative or print, *e.g.*, silver image.

INFINITY.—Very great distance compared with the focal length of a lens, say 200 to 500 times focal length of lens.

INTENSIFICATION.—The process of increasing the density and (usually) contrast of a negative or print.

INTENSITY (of lens)—*i.e*, speed as denoted by F No., which see.

KALLITYPE.—A process of printing with sensitive iron compounds in conjunction with silver salts.

LATENT IMAGE.—Effect of light, produced by exposure in a camera or otherwise, which is invisible until treatment of the plate or paper by a "developer."

LATITUDE.—Property of plate or paper to yield good negative or print when more or less than the correct exposure is given.

LIGHT-FILTER.—A screen of coloured glass or dyed film, serving to absorb rays of certain colours, the remainder passing through.

MAGIC PHOTOGRAPHS.—Prints, the pictures on which are rendered invisible by bleaching, but can be made visible again by simple treatment, *e.g.*, by heating, by exposure to light or by hypo or ammonia.

M.Q.—Metol-hydroquinone developer.

NEGATIVE.—Any photographic result in which light and shade are reversed, as compared with the subject, *i.e.*, light parts, dark, and vice versa.

ORTHOCHROMATIC.—Applied to plates which are rendered colour-sensitive to such a degree that they are affected to a fairly high degree by green and yellow rays.

OVER-DEVELOPMENT.—Development for too long a time.

OZOBROME PROCESS—of making a carbon print through the medium of a bromide print and without exposure to light.

PANCHROMATIC.—Descriptive of a plate rendered sensitive to rays of all colours.

PASSE-PARTOUT.—A neat method of protecting prints for wall display consisting in binding the mounted print to a glass same size as the mount, the latter having rings attached to it for suspension of the whole "passe-partout."

PINHOLES.—Minute clear spots in a negative due to dust on the plate before development or tiny bubbles of air adhering to the film when developer is flowed on.

PNEUMATIC HOLDER.—A rubber bulb formed flat at the end where the aperture is. It serves for holding plates when varnishing, etc.

PNEUMATIC RELEASE.—Actuation of a shutter by air pressure provided by compression of a rubber bulb.

P.O.P.—(Printing-out paper)—The contraction first used for gelatine print-out paper by the Ilford Co., and since then retained for this description of paper.

RAPID RECTILINEAR LENS.—A double lens consisting of two double cemented components, each, usually, of the same focal length. The "speed" of the whole lens is about $f/8$.

REDUCER.—Solution which reduces the density of a negative, usually by dissolving away part of the silver image.

Reflex Camera.—One in which the image formed by the lens is reflected by a mirror on to a focussing screen, placed, as a rule, in the top of the camera whilst the plate faces the lens. On release the mirror rises, and the shutter then exposes the plate.

Repeating Back.—A sliding frame at the back of the camera, carrying both focussing screen and dark-slide and allowing of different exposures being made on different sections of a plate.

Restrainer.—The agent (usually bromide) which slows down the speed of development.

Retouching.—Improving the tones—and often the outlines of the subject—in a negative by touching with a pencil or cutting away with a knife.

Reversal.—In negatives—the production of a positive instead of a negative, or vice versa *e.g.* by gross over-exposure or chemical means.

Reversing Back.—The loose square back frame of a camera carrying dark-slide and focussing screen. It permits of being used either vertically or horizontally (as required by the shape of the subject) without turning the camera over.

Rising Front —The front or lens-board of the camera which can be raised or lowered. A useful amount of rise is $\frac{1}{3}$ to $\frac{1}{2}$ the height of the plate ; of fall, $\frac{1}{4}$ to $\frac{1}{2}$.

Roll Film.—Thin celluloid coated with the sensitive emulsion and wound, with a paper strip, on a spool. Extra length of the paper at each end allows of the sensitive band being drawn into position for exposure (and withdrawn when the whole length has been exposed) in daylight.

Roll-Holder.—A separate chamber for the exposure of roll films. It can be attached to any camera, and so allows the film to be used in cameras not specially made for it. Now (1914) largely gone out of use.

Rotating Back —The carrier frame of the focussing screen and dark-slide at the back of the camera. It is "revolvably" mounted on the back, whilst a reversing back (which see) is loose.

Safe Edge.—An opaque coating on the margins of a negative. It obstructs the action of light and is necessary in carbon printing.

Safe-Light.—The screen used in the dark-room lamp to supply a yellow, red or green light, according to the sensitiveness of the plate or paper. Of glass, or more usually of late years of dyed gelatine films between glass plates.

Saturated Solution.—One which will dissolve no more at a given temperature.

Screen-plate (colour).—A plate coated with a minute irregular or regular pattern of colour patches (red, green and blue-violet) with a coating of emulsion over it. For colour photography direct, *e.g.*, Autochrome, Dufay, Paget.

Self-toning Paper.—Printing-out paper which contains the gold required for toning it, the latter acting when the print is put in a hypo fixing bath

Separable Lens.—A doublet lens each component of which can be used as a separate lens.

SEPIA PAPER.—Printing paper with a coating of sensitive iron salt containing also silver. It yields a reddish sepia colour on fixing in weak hypo.

SHADOWS.—In a negative, the clearest (thinnest) parts; in a print, the darkest parts.

SIDE SWING.—Movement of the camera back about an upright axis, so that the back is at an angle with the front (instead of parallel with it) when looking down from above.

SINGLE LENS—or "landscape"—of two or more glasses cemented together, as distinguished from a doublet, which consists of two such single lenses with the stop between them.

SIZING.—Process of filling up the pores in paper by a coating of arrowroot, gelatine, etc.

SKY-SHADE.—A screen, on the shutter or lens-tube, which cuts off part of the light from the sky.

SOFT.—Applied to negatives and prints to indicate lesser degree of contrast, but not so much as to be called "flatness."

SOLARIZED.—Commonly used to describe the bronzed metallic appearance of the shadows in prints greatly over-printed.

SPECTACLE LENS.—A lens of one glass only, therefore non-achromatic and requiring to be of relatively long focus to cover a given size of plate.

SPHERICAL ABERRATION.—Defect of a lens to bring rays passing through its centre and edge to the same focus. Causes general unsharpness, but is cured by using a smaller stop.

SQUEEGEE.—A stout strip of rubber, or roller covered with rubber, for pressing prints, *e.g.*, when glazing them on glass or before hanging to dry.

STAND DEVELOPMENT.—Development of plates with a weak solution acting for a much longer time. The plates are usually placed upright in a tank, and are taken out when seen to be of sufficient density.

STAND DEVELOPER—that is a very weak solution used for a long time, say, 1 hour or more, the plates being contained in a tank. Final density judged by looking at the negatives.

SULPHIDE TONING.—Obtaining a brown to sepia tone on bromide or gaslight prints by converting the silver image into silver sulphide, usually first bleaching the print and then placing in sulphide solution. Hot solution of hypo and alum produces partial formation of sulphide and the tone is purplish.

SULPHUR TONING.— An impermanent toning effect which takes place when P.O.P. prints are fixed a bath of hypo which is acid.

SUPPLEMENTARY LENS.—An extra lens used to lengthen or shorten the focal length.

SWING BACK.—Back of a camera which can be inclined to form an angle with the front when viewed from the side. Permits of the back being kept upright when the camera is pointed upwards or downwards.

SWING FRONT.—Front of a camera which is mounted so that the lens can be pointed upwards or downwards independently of tilt of the whole camera.

SYMMETRICAL LENS.—One (doublet) in which each component is of similar construction and the same focal length.

TELEPHOTO LENS.—A lens giving a very large image of an object with a relatively short camera extension. It consists of a negative or diverging lens placed behind an ordinary positive lens, the negative magnifying the image formed by the positive.

THERMO-DEVELOPMENT.—The system (of Watkins) of adjusting the time of development in accordance with the temperature of the developer, and without inspecting the negatives.

THREE-COLOUR PROCESS.—The system of reproducing colours by dividing the rays of light from the subject into three sets, each of a given colour, recording these on sensitive plates and from the negatives preparing positives which are used, stencil-fashion, to produce the mixture of coloured rays (from suitable sources) required to re-form the original colours. Practically all methods of "colour photography" are on this system.

TIME DEVELOPMENT.—Developing for a fixed time at a given temperature instead of judging end of development by the appearance of the negatives.

TIME EXPOSURES.—Those of such length that they can be given by hand-operation of the cap or shutter, *e.g.*, half-a-second and upwards.

TONE.—Used to denote colour, *e.g.*, sepia tone. Also depth or intensity of any part of a photograph, *e.g.*, "light tone", "dark tone" in which use of the word there is no reference to colour.

TWIN-LENS CAMERA.—One fitted with two identical lenses, by one of which the image is formed on the focussing screen (where it can be seen and focussed) whilst the other (which moves with the first when focussing) casts an image on the plate.

U.S.—Denotes the "Uniform System" of diaphragm or stop numbers according to which *f*/4 is 1; *f*/5 6, 2; *f*/8, 4, and so on.

VIEW-FINDER.—A miniature camera or lens serving to show on a smaller scale the picture obtained with the full size instrument to which it is fitted.

VIEW-METER.—An arrangement, usually of a rod fitted with an eye-piece or sliding frame, by which the views included with a given size of plate with lenses of various focal lengths can be judged.

VISUAL FOCUS.—The point at which the rays most perceived by the eye, viz., green and yellow, meet after passing through a lens.

WET COLLODION PROCESS.—That in which a glass plate was coated with collodion containing iodide, rendered sensitive with silver nitrate and exposed whilst wet.

EQUIVALENTS IN GERMAN, FRENCH AND ITALIAN OF THE CHIEF PHOTOGRAPHIC TERMS.

The following Table is a re-arrangement of one published in the "Deutsche Photographen Zeitung," to which journal we acknowledge our indebtedness.—Ed. B. J. A.

English.	*German.*	*French.*	*Italian.*
Acetate	Essigsauer	Acétate	Acetato
Acid	Säure	Acide	Acido
Alum	Alaun	Alun	Allume
Angle, wide (see	Wide Angle)		
Anhydrous	Wasserfrei	Anhydre	Anidro
Arc lamp	Bogenlampe	Lampe à arc	Lampada ad arco
Background	Hintergrund	Fond	Fondo
Baseboard	Laufboden	Base	Base-guida
Bath, fixing (see	Fixing Bath)		
Bellows	Balgen	Soufflet	Soffietto
Bleach out, to	Ausbleichen	Blanchir	Decolorare, Imbianchire
Blotting paper	Fliesspapier	Papier buvard	Carta Sugante
Bromide paper	Bromsilber-papier	Papier au gelatino-bromure	Carta al bromure d'argento
Bulb	Ball	Poire	Pera
Blister (Air-bell)	Blase	Boulle, ampoule	Bolla
Camera	Kamera	Chambre noire	Apparecchio
Camera, folding	(see Folding	Camera)	
Carbonate	Kohlensauer	Carbonate	Carbonato
Caustic (potash)	Ätz-(Kalium)	Caustique	Caustico
Combined bath	Tonfixierbad	Virage-fixage	Bagno viro-fissatore Bagno viro-fissaggio
Common salt	Kochsalz	Sel marin	Sale da cucina
Copper	Kupfer	Cuivre	Rame
Crack (*e.g.* in film)	Riss	Cassure, craquelure	Screpolatura
Cream (Tint)	Chamois	Chamois	Camoscio
Dark-room	Dunkelkammer	Laboratoire	Laboratorio

Equivalents of the chief Photographic terms—*continued.*

English.	*German.*	*French.*	*Italian.*
Dark-room lamp	Dunkelkammer-lampe	Lanterne de laboratoire	Lampada del laboratorio
Dark-slide	Kassette	Châssis	Telaio
Daylight	Tageslicht	Plein jour	Piena luce
Depth of focus	Schärfentiefe	Profondeur de champ	Profondità de' campo (fuoco)
Develop, to	Entwickeln	Développer	Sviluppare
Developer	Entwickler	Développateur, révélateur	Sviluppatore, rivelatore
Development	Entwicklung	Dévéloppement	Sviluppo
Diaphragm	Blende	Diaphragme	Diaframma
Dish	Schale	Cuvette	Bacinala
Dry, to	Trocknen	Secher	Disseccare
Dry-plate	Trockenplatte	Plaque sèche	Lastra secca
Enlargement	Vergrösserung	Agrandissement	Ingrandimento
Exhibition	Austellung	Exposition	Esposizione
Expose, to	Belichten	Exposer	Esporre
Exposure	Belichtung	Pose, exposition	Esposizione
Exposure, time of	Belichtungszeit	Temps de pose	Durata od. tempo di posa i.e. esposizione
Extension (Camera)	Auszug	Extension, tirage	Tiraggio, estensione
Fill (see Load)			
Film	Film	Pellicule	Pellicola
Finder	Sucher	Viseur	Mirino
Fix, to	Fixieren	Fixer	Fissare
Fixing and Ton	ing, combined	(see "Combined	Bath")
Fixing bath	Fixierbad	Bain fixateur	Bagno fissativo
Flashlamp	Blitzlichtlampe	Lampe éclair	Lampada lampo
Flashlight	Blitzlicht	Eclair	Luce lampo
Flashpowder	Blitzlichtpulver	Poudre éclair	Polvere lampo
Flat	Flau	Flou	Flou
Focal length	Brennweite	Distance focale	Distanza focale
Focal-plane shutter	Schlitzverschluss	Obturateur de plaque or à rideau	Ottoratore a tendina
Focus	Brennpunkt	Foyer	Fuoco
Focus, depth (see	Depth of Focus)		
Focussing	Einstellung	Mise au point	Messa a punto or. faco
Focussing screen	Mattscheibe	Glace depolie Verre depoli	Vetro smerigliato Lastra smerigliata
Fog	Schleier	Voile	Velo

Equivalents of the chief Photographic terms—*continued.*

English.	*German.*	*French.*	*Italian.*
Folding (camera)	Klappkamera	(Appareil) pliant	(Camera) pieghevole
Frame	Rahmen	Cadre	Telaio
French chalk	Schlemmkreide	Craie lévigée	Creta levigata (bianca)
Glossy	Glänzend	Brillant	Brillante
Gold chloride	Goldchlorid	Chlorure d'or	Chloruro d'oro
Gold toning bath	Goldbad	Virage à l'or	Viraggio a l'oro
Gun-cotton	Schiessbaum-wolle	Coton poudre	Cotone polve e
Half-tone	Autotypie	Demie teinte	Mezzatinta
Hydrochloride	Salzsauer	Chloridrate	Cloridrato
Hydrogen per-oxide	Wasserstoff-superoxyd	Eau oxygenée	Aqua ossigenata
Hypo	Fixiernatron	Hyposulfite	Iposolfito
Image	Bild	Image	Immagine
Instantaneous	Moment	Instantané	Instantanea
Intensifier	Verstärker	Renforçateur	Rinforzatore
Intensify, to	Verstärken	Renforcer	Rinforzare
Intensification	Verstärkung	Renforcement	Rinforzamento
Interior	Innenraum	Interieur	Interno
Iron	Eisen	Fer	Ferro
Lamp, dark-	room (see Dark-	room Lamp)	
Landscape	Landschaft	Paysage	Paesaggio
Lantern-slide	Diapositiv	Diapositif	Diapositivo
Lead	Blei	Plomb	Piombo
Lens (complete)	Objektiv	Objectif	Obbiettivo
Lens (single glass)	Linse	Lentille	Lente
Lens, telephoto (see Telephoto Lens)			
Level	Libelle	Niveau	Livella
Light-filter	Filter	Ecran	Schermo
Lighting	Beleuchtung	Eclairage	Illuminazione
Load, to (dark slides)	Einlegen	Charger	Caricase
Measure-glass	Messzylinder	Mesure	Misura
Mercury bi-chloride	Sublimat	Bichlorure de mercure	Bicloruro di mercurio
Mount, to	Aufziehen	Monter	Montare
Mountant	Kleister	Colle	Pasta, colla
Negative	Negativ	(Cliché) négatif	Negativo
Nitrate	Salpetersauer	Azotate	Azotato
Oxalate	Oxalsauer	Oxalate	Ossalato

Equivalents of the chief Photographic terms—*continued.*

English.	*German.*	*French.*	*Italian.*
Permanence	Haltbarkeit	Conservation	Conservazione
Permanent	Haltbar	Inaltérable	Inalterabile
Plate	Platte	Plaque	Lastra
Platinum toning bath	Platin-tonbad	Virage au platin	Viraggio al platino
P.O.P. (printing-out paper)	Aristopapier	Papier au citrat d'argent	Carta al citrato
Potassium	Kalium	Potassium	Potassio
Potassium bromide	Bromkalium	Bromure de potassium	Bromuro di potassio
Potassium carbonate	Pottasche	Carbonate de potassium	Carbonato potassico
Potassium chloroplatinite	Kaliumplatinchlorür	Chloroplatinite de potassium	Cloroplatinito di potassio
Potassium ferricyanide	Blutlaugensalz, rotes	Ferricyanure de potassium	Ferricianuro di potassio Prussiato rosso
Print, to	Kopieren	Tirer	Stampare
Print	Kopie	Épreuve	Stampa
Printing frame	Kopierrahmen	Châssis presse	Torchietto
Rack and pinion	Trieb	Crémaillère	Crensagliera
Rapidity (lens)	Lichtstärke	Luminosité	Luminosità
Reduce, to	Abschwächen	Affaiblir	Indebolire
Reducer	Abschwächer	Affaiblisseur	Riduttore
Reducing	Abschwächung	Affaiblissement	Indebolimento
Release	Auslösung	Déclenchement	Scatto
Release, to	Auslösen	Déclencher	Scattare
Reversing	Umkehrung	Inversion	Rovesciamento
Roll-film	Rollfilm	Pellicule en bobine	Pellicola a rotolo
Salt, common	(see Common	Salt)	
Screen (reflecting)	Schirm	Réflecteur	Schermo
Screen (ruled)	Raster	Réseau	Reticolo
Screw (tripod)	Mutter	Ecrou	Spira, madrevite
Self-toning	Selbsttonend	Auto-vireur	Autovirante
Set, to (shutter)	Spannen	Armer	Caricare
Sharp (lens)	Scharf	Net	Nitido
Sharpness	Schärfe	Netteté	Nitidezza
Shutter	Verschluss	Obturateur	Otturatore
Shutter, focal-	plane (see	Focal-plane	Shutter)
Slit	Schlitz	Fente	Fessura
Sodium carbonate	Soda	Carbonate de soude	Carbonato sodico
Speed	Empfindlichkeit	Sensibilité	Sensibilita

Equivalents of the chief Photographic terms—*continued.*

English.	*German.*	*French.*	*Italian.*
Spool	Spule	Bobine	Bobina
Squeegee, to	Quetschen	Rouler	
Squeegee	Quetscher	Rouleau	
Starch	Stärke	Amidon	Amidone
Stop down, to	Abblenden	Diaphragmer	Diaframmare
Studio	Atelier	Atelier	Studio
Sulphocyanide	Rhodan	Sulfocyanure	Solfocianuro
Sulphide toning	Schwefeltonung	Virage { Parsulfuration / Sulfurée	Viraggio { per solforazoine al solfuro
Sulphite	Sulfite	Sulfite	Solfito
Take, to (a picture)	Aufnehmen	Poser	Posare
Tartrate	Weinsauer	Tartrate	Tartrato
Telephoto lens	Fernobjektiv	Téléobjectif	Teleobiettivo
Tone, to	Tonen	Virer	Virare
Toning and fixing	combined (see	"Combined	bath")
Toning Bath	Tonbad	Bain de virage	Bagno { da viraggio / viratore
Tripod	Stativ	Pied	Treppiede
Varnish	Lack	Vernis	Vernice
Wide angle	Weltwinkel	{ à grand angle / grand angulaire	Grand-angolare

MISCELLANEOUS INFORMATION.

List of the Principal Works on Photography.

[The books mentioned below are obtainable by order of all photo graphic dealers.]

ELEMENTARY AND GENERAL TEXT-BOOKS.

Amateur Photography. By F. T. Beeson and A. Williams. 1*s*.

Elementary Photography. By John A. Hodges. 1*s*.

Ilford Manual of Photography. By C. H. Bothamley. 1*s*.

Sinclair Handbook of Photography. 1*s*.

Barnet Book of Photography. 1*s*. 6*d*.

A Primer of Photography. By Captain Owen Wheeler. 2s. 6d.

Early Work in Photography. By W. Ethelbert Henry. 1*s*.

Hand-Camera Photography. By Walter Kilbey. 1s.

Photography in a Nutshell. By the Kernel. 1*s*.

Photographic Reference Book. By J. McIntosh. 1*s*. 6*d*.

The Science and Practice of Photography. By Chapman Jones. 5*s*.

Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7*s*. 6*d*.

Dictionary of Photography. By E. J. Wall. 7*s*. 6*d*.

The Complete Photographer. By R. Child Bayley. 10*s*. 6*d*.

Photography, By Alfred Watkins. 6s.

Photography: Its History, Processes, Apparatus and Materials. By A. Brothers. 21*s*.

Photography in Principle and Practice. By S. E. Bottomley. 3*s*. 6*d*.

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Photographic Copyright. By George E. Brown, F.I.C., and Alexander Mackie. 1*s*

PHOTOGRAPHIC OPTICS AND CHEMISTRY.

Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2*s*.

Photographic Lenses. By Conrad Beck and Herbert Andrews. 1s.

The Lens. By Thos. Bolas and George E. Brown. 2s. 6d.

The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3s. 6d.

System of Applied Optics. By H. Dennis Taylor. 30s.

Photographic Optics, a Treatise on. By R. S. Cole. 6s.

Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6s.

First Book of the Lens. By C. Welborne Piper. 2s. 6d.

Telephotography. By T. R. Dallmeyer. 21s.

Modern Telephotography. By Captain Owen Wheeler. 1s. 6d.

Practical Telephotography. (No. 90 of "The Photo-Miniature.")

Lens-work for Amateurs. By Henry Orford. 3s.

Tables of Conjugate Foci. By J. R. Gotz. 6d.

Chemistry for Photographers. By Charles F. Townsend, F.C.S. 1s.

The Chemistry of Photography. By R. Meldola. 6s.

Investigations on the Photographic Processes. By S. E. Sheppard, D.Sc., and C. E. Kenneth Mees, D.Sc. 6s. 6d.

Art, Portraiture, Hand-camera Work, Etc.

Art Principles in Portrait Photography. By C. W. Beck. 12s. 6d.

Picture-making by Photography. By H. P. Robinson. 2s. 6d.

Photography on Tour. 6d.

Correct Exposure. (No. 105 of "The Photo-Miniature.")

Practical Landscape Photography. By G. T. Harris. 1s.

The Photographic Studio. A guide to its construction, etc. By T. Bolas. 2s.

The Lighting in Photographic Studios. By P. C. Duchochois Revised, with additional matter, by W. Ethelbert Henry, C.E. 1s.

Magnesium Light Photography. By F. J. Mortimer. 1s.

Hand-Cameras. By R. Child Bayley. 1s. 6d.

Hand-Camera Work. (No. 107 of "The Photo-Miniature.")

Reflex Cameras. (No. 99 of "The Photo-Miniature.")

Photography of Moving Objects and Hand-camera Work for Advanced Workers. By Adolphe Abrahams. 1s.

Instantaneous Photography. By Sir William Abney. 1s.

Copying Methods. (No. 41 of "The Photo-Miniature.")

Panoramic Photography. (No. 73 of "The Photo-Miniature.")

Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2s.

Stereoscopic Photography. (No. 98 of "The Photo-Miniature.")

Photo-micrography. By E. J. Spitta. 12s.

Practical Photo-micrography. By Andrew Pringle. 3s. 6d.

Negative Processes.

Wet-collodion Photography. By Charles W. Gamble. 1s.

The Wet Collodion Process. By Arthur Payne. 3s.

Collodion Emulsion. By H. O. Klein. 5s.

Practical Orthochromatic Photography. By Arthur Payne. 1s.

The Photography of Coloured Objects. By C. E. Kenneth Mees, D.Sc. 1s.

Negative-making. By Sir William Abney, F.R.S. 1s.

The Watkins' Manual (of exposure and development). By Alfred Watkins. 1s.

Photography by Rule. By J. Sterry. 1s.

Finishing the Negative. Edited by H. Snowden Ward. 1s.

Retouching. By Arthur Whiting. 1s.

Art of Retouching. By J. Hubert. 1s.

Art of Retouching Negatives, and Finishing and Colouring Photographs. By T. S. Bruce and Alfred Braithwaite. 2s. 6d.

Printing Processes.

Photographic and Photo-mechanical Printing Processes. By W. K. Burton. 4s.

Art and Practice of Silver Printing. By Sir William Abney and Robinson. 2s. 6d

Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6d.

Toning Bromide Prints. By R. Blake Smith. 1s.

Toning Bromides. By C. W. Somerville. 1s.

Toning Bromide and Gaslight Prints. (No. 103 of "The Photo. Miniature.")

Photographic Enlarging. By R. Child Bayley. 1s. 6d.

Photographic Enlargements: How to Make Them. By Geo. Wheeler. 1s.

A B C Guide to Autotype Permanent Photography. By J. R Sawyer, 1s.

Carbon Printing. By E. J. Wall. 1s.

Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1s.

Oil and Bromoil Printing. (No. 106 of "The Photó-Miniature.")

Platinotype Printing. By A. Horsley Hinton. 1s.

Ferric and Heliographic Processes. By George E. Brown. 2s.

Photographic Reproduction Processes. By P. C. Duchochois. A treatise on photographic impressions without silver salts. 2s. 6d.

Photo-ceramics. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1s. 6d.

Trimming, Mounting, and Framing. (No. 102 of "The Photo-Miniature.")

LANTERNS AND LANTERN SLIDES: CINEMATOGRAPH.

Modern Magic Lanterns. By R. Child Bayley. 1*s.*

The Lantern, and How to Use It. By Goodwin Norton. 1*s.*

Optical Projection. By Lewis Wright. 6*s.*

The Optical Lantern: for Instruction and Amusement. By Andrew Pringle. 2*s.* 6*d.*

Practical Slide-making. By G. T. Harris. 1*s.*

Colouring Lantern Slides. (No. 83 of "The Photo-Miniature.")

Living Pictures. By H. V. Hopwood. 2*s.* 6*d.*

Animated Photography. By Cecil M. Hepworth. 1*s.*

The Handbook of Kinematography. By Colin N. Bennett. 5*s.*

The Modern Bioscope Operator. 1*s.* 6*d.*

PHOTO-MECHANICAL PROCESSES, ETC.

Horgan's Half-tone and Photo-mechanical Processes. By S. H. Horgan. 12*s.* 6*d.*

Half-tone Process, The. By Julius Verfasser. 5*s.*

Half-tone Process on the American Basis. By Wm. Cronenberg. 2*s.*

A Treatise on Photogravure in Intaglio. By the Talbot Klic process. By Herbert Denison. 4*s.* 6*d.*

Photo-Mechanical Processes. By W. T. Wilkinson. 4*s.*

Photo-aquatint and Photogravure. By Thomas Huson. 2*s.*

Professional Photography. By C. H. Hewitt. Vol. I., 1*s.* Vol. II., 1*s.*

Photography for the Press. By the Editors of *The Photographic Monthly.* 1*s.*

Practical Radiography. A handbook of the applications of the X-rays. By A. W. Isenthal and H. Snowden Ward. 6*s.*

COLOUR PHOTOGRAPHY.

Photography in Colours. By Bolas, Tallent and Senior. 1*s.* 6*d.*

Three-colour Photography. By Baron von Hübl. Translated by H. O. Klein. 7*s.* 6*d.*

Natural-colour Photography. By Dr. E. König. Translated by E. J. Wall. 2*s.*

COPYRIGHT IN PHOTOGRAPHS.

The law of the reproduction of photographs is now governed by the Copyright Act, 1911, which came into force in Great Britain and in some minor British Protectorates on July 1, 1912.

The Copyright (Works of Art) Act, 1862, given in previous editions of the "Almanac," is repealed with the exception of Sections 7 and 8.

The new Act provides protection for all classes of work, both literary and artistic, and is, therefore, a lengthy one, but the chief provisions as to photographs are given below. For a full and adequate, yet simple, treatment of the subject, as far as possible in non-legal language, the reader is referred to "Photographic Copyright," written by the Editor of this Almanac in conjunction with Alexander Mackie, hon. secretary of the Professional Photographers' Association, and published by Messrs. H. Greenwood and Co., 24, Wellington Street, Strand, London, W.C., price 1s. net; post free, inland and abroad, 1s. 2d.

Copyright in a photograph lasts for fifty years from the making of the negative.

Registration of copyright is abolished.

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In accordance with certain unrepealed clauses of the Copyright Act of 1862 it is an offence against the photographer for his work to be fraudulently issued with a false name or marking, or to be exhibited or sold falsely marked. Copies of photographs may not be issued as having been made by the original author, and a photograph in which unauthorised alterations have been made must not be issued as the unaltered work of the author.

Reproduction Fees.

The Copyright Union has drawn attention to the following suggestions, drawn up for the guidance of its members, by Mr. Alfred Ellis :—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example: a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 ins.; when printed with letterpress in one issue of a newspaper; but if it is to be printed as an inset the fee should be at least one guinea. If printed in colours, collotype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertising purposes a higher fee should be charged than for newspaper work. In all cases the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced, and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

The fee for reproduction on postcards should be not less than 10s. 6d. royalty per thousand for half-tone or collotype, and £1 1s. per thousand for bromide or ordinary photographic processes.

TABLES.

WEIGHTS AND MEASURES.

The formulæ in the editorial pages of this ALMANAC are given, in almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula—20 ozs. or 1000 c.c.s. as a rule.

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains, while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims; that is to say, 4375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2·3. Ounces per any given number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the "dry" ("anhydrous") forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

20 Grains = 1 Scruple.
3 Scruples = 1 Drachm = 60 Grains.
8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.
¼ ounce = 109 grains; ½ ounce = 219 grains; ¾ ounce = 328 grains.

3. FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms.
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms.

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0·91 grains.

Metric Weights and Measures.

The unit of weight is the gramme, written "gm."; the subdivisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th); the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the term 0·1 or 0·01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures:—

LINEAR MEASURE.

1 Millimetre (mm.) (1/1000th M.)	=	0·03937 inch
1 Centimetre (1/100th M.) ..	=	0·3937 ,,
1 Metre (M.)	=	39·370113 inches 3·280843 feet 1.0936143 yards
Kilometre (1000 M.)	=	0·62137 mile

SQUARE MEASURE.

1 Square Centimetre	=	0·155 square inch
1 Square Metre (100 square decimetres)	=	10·7639 square feet 1·196 square yards

WEIGHT.		*Avoirdupois.*
1 Milligramme (1/1000th gm.) ..	=	0·015 grain
1 Gramme (1 gm.)	=	15·432 ,,
1 Kilogramme (1000 gm.) ..	=	2·2046223 lbs. or 35·273957 ozs.

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* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains), but in cases where "drachms" are given the apothecaries' drachm of 60 grains is taken as the unit.

Fluid Measure.

1 Cubic centimetre* (c.c.) (1/1000th litre) = 16·9 minims
1 Litre (1 L.) = 35 ozs. 94 m. = 16894·1 minims

Conversion of Metric into British Measures.

GMS. PER LITRE INTO GRAINS PER 10* OZS.

The following table gives the most convenient means of translating metric formulæ into British measures.

* The figures given in Columns 2, 4, and 6 are a correct translation of the metric proportion when the solution is measured out in ounces and fractions of an ounce. If to be measured in minims, the quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drs. of water.

1 Gms. Per Litre.	2 Grs. Per 10† ozs.	3 Gms. Per Litre	4 Grs. Per 10† ozs.	4 Ozs. Grs. Per 10† ozs.	5 Gms. Per Litre.	6 Grs. Per 10† ozs.	6 Ozs. Grs. Per 10† ozs.
1	4·4	30	131	¼—22	155	678	1½—22
2	8·8	35	153	¼—44	160	700	1½—44
3	13·1	40	175	¼—66	165	722	1½—66
4	17·5	45	197	¼—88	170	744	1½—88
5	21·9	50	219	½—0	175	766	1¾—0
6	26·2	55	241	½—22	180	788	1¾—22
7	30·6	60	262	½—43	185	809	1¾—43
8	35·0	65	284	½—65	190	831	1¾—65
9	39·4	70	306	½—87	195	853	1¾—87
10	43·8	75	328	¾—0	200	875	2
11	48·1	80	350	¾—22	225	984	2¼
12	52·5	85	371	¾—43	250	1,094	2½
13	56·9	90	393	¾—65	275	1,203	2¾
14	61·2	95	415	¾—87	300	1,313	3
15	65·6	100	437	1 —0	325	1,422	3¼
16	70·0	105	459	1 —22	350	1,531	3½
17	74·4	110	481	1 —44	375	1,641	3¾
18	78·8	115	503	1 —66	400	1,750	4
19	83·1	120	525	1 —88	425	1,859	4¼
20	87·5	125	547	1¼—0	450	1,969	4½
21	91·9	130	569	1¼—22	475	2,078	4¾
22	96·2	135	591	1¼—44	500	2,187	5
23	100·6	140	613	1¼—66			
24	105·0	145	634	1¼—87			
25	109·4	150	656	1½—0			

† *N.B.*—Quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drs. when solutions are to be measured out in minims.

* *Millilitre and C C.*—Revisions of metric standards have shown that the litre is not exactly 1000 c.c.s., but 999·84 c.c.s. (according to Mendeleef's calculations from the experimental data). The difference appears sufficiently serious in official circles to warrant the abandonment of the term "cubic centimetre," and the employment of "millilitre" for the true thousandth part; millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c.c. from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible, not more than 4 drops in 35 ozs.

GRAMMES INTO GRAINS AND OUNCES (AVOIRDUPOIS).

Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.
0·1		1·5	16	½	28·1	130	4½	37
0·2		3·1	17	½	43·5	140	4¾	82
0·3		4·6	18	½	59·0	150	5¼	118
0·4		6·2	19	½	74·4	160	5½	61
0·5		7·7	20	½	89·8	170	6	0
0·6		9·1	25	¾	57·0	175	6	76
0·7		10·8	30	1	25	180	6¼	44
0·8		12·4	35	1	103	190	6½	88
0·9		13·9	40	1¼	71	200	7	24
1		15·4	45	1½	38	250	8¾	32
2		30·9	50	1¾	6	300	10½	31
3		46·3	55	1¾	83	350	12¼	41
4		61·7	60	2	51	400	14	50
5		77·2	65	2¼	19	450	15¾	52
6		92·6	70	2¼	94	500	17½	61
7		108·0	75	2½	64	550	19¼	66
8	¼	14·1	80	2¾	32	600	21	70
9	¼	29·5	85	3	0	650	22¾	72
10	¼	44·9	90	3	76	700	24½	81
11	¼	60·4	95	3¼	44	750	26¼	91
12	¼	75·8	100	3½	11	800	28	95
13	¼	91·2	110	3¾	56	850	29¾	102
14	¼	106·7	120	4	102	900	31½	106
15	½	12·7	125	4¼	70	1000	35¼	11

Note.—In the above table the British equivalents are given in the form most convenient for actual work, viz., in even ounces and quarter ounces, with odd grains over. If calculations need to be made, the following figures giving the equivalents of ounces and quarter-ounces in grains will be found useful :—

¼ oz. = 109 grs.	1¾ oz. = 765 grs.	3¼ ozs. = 1,421 grs.	4¾ ozs. = 2,078 grs.
½ oz. = 219 grs.	2 ozs. = 875 grs.	3½ ozs. = 1,531 grs.	5¼ ozs. = 2,296 grs.
¾ oz. = 328 grs.	2¼ ozs. = 984 grs.	3¾ ozs. = 1,640 grs.	5½ ozs. = 2,406 grs.
1 oz. = 437 grs.	2½ ozs. = 1,094 grs.	4 ozs. = 1,750 grs.	6 ozs. = 2,625 grs.
1¼ oz. = 546 grs.	2¾ ozs. = 1,203 grs.	4¼ ozs. = 1,859 grs.	6¼ ozs. = 2,734 grs.
1½ oz. = 656 grs.	3 ozs. = 1,312 grs.	4½ ozs. = 1,969 grs.	6½ ozs. = 2,844 grs.

C.C.S. INTO MINIMS AND OUNCES (FLUID).

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.
1		16·9	6		101·4	11	¼	66
2		33·8	7		118·3	12	¼	83
3		50·7	8	¼	15·2	13	¼	100
4		67·6	9	¼	32	14	¼	117
5		84·5	10	¼	49	15	½	13

C.C.S. INTO MINIMS AND OUNCES (FLUID).—*Continued.*

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.
16	½	30	120	4	107	500	17½	47
17	½	47	125	4¼	72	525	18¼	110
18	½	64	130	4½	36	550	19¼	52
19	½	81	140	4¾	85	575	20	114
20	½	98	150	5¼	14	600	21	56
25	¾	82	160	5½	63	625	22	0
30	1	27	170	5¾	112	650	22¾	61
35	1	111	175	6	76	675	23¾	4
40	1¼	76	180	6¼	41	700	24½	66
45	1½	40	190	6½	90	725	25½	8
50	1¾	5	200	7	20	750	26¼	70
55	1¾	89	225	7¾	81	775	27¼	13
60	2	54	250	8¾	24	800	28	75
65	2¼	18	275	9½	86	825	29	18
70	2¼	103	300	10½	28	850	29¾	80
75	2½	67	325	11¼	90	875	30¾	22
80	2¾	32	350	12¼	33	900	31½	65
85	2¾	116	375	13	95	925	32½	27
90	3	81	400	14	37	950	33¼	90
95	3¼	45	425	14¾	100	975	34¼	32
100	3½	10	450	15¾	42	1000	35	94
110	3¾	58	475	16½	105			

Conversion of British into Metric Measures.

GRAINS INTO GRAMMES.

Grs.	Gms.	Grs.	Gms.	Grs.	Gms.
1	0·065	16	1·037	35	2·268
2	0·13	17	1·102	40	2·592
3	0·194	18	1·166	45	2·916
4	0·259	19	1·232	50	3·240
5	0·324	20	1·296	55	3·564
6	0·389	21	1·361	60	3·888
7	0·454	22	1·426	65	4·212
8	0·518	23	1·490	70	4·536
9	0·583	24	1·555	75	4·860
10	0·648	25	1·620	80	5·184
11	0·713	26	1·685	85	5·508
12	0·775	27	1·750	90	5·832
13	0·842	28	1·814	95	6·156
14	0·907	29	1·880	100	6·480
15	0·972	30	1·944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Ozs.	Gms.	Ozs.	Gms.	Ozs.	Gms.
¼	7·09	4	113·40	13	368·54
½	14·17	5	141·75	14	396·89
¾	21·26	6	170·10	15	425·24
1	28·35	7	198·45	16	453·59
1½	42·5	8	226·80	17	481·94
2	56·70	9	255·15	18	510·29
2½	70·87	11	311·8	19	538·64
3	85·05	12	340·19	20	566·99

FLUID OUNCES AND DRACHMS TO C.C.S.

Minims.	C.c.s.	Drs.	C.c.s.	Ozs.	C.c.s.	Ozs.	C.c.s.
5 =	·3	½	1·78	1½	42·6	11	312·5
10 =	·6	1	3·55	2	56·8	12	341·0
15 =	·9	2	7·10	3	85·2	13	369·3
20 =	1·2	3	10·65	4	113·6	14	398·0
25 =	1·4	4	14·20	5	142·0	15	426·0
		5	17·75	6	170·5	16	454·5
		6	21·30	7	198·9	17	483·0
		7	24·86	8	227·3	18	511·5
		8	28·41	9	255·7	19	540·0
				10	284·0	20	568·0

CONVERSION RULES.

Grammes per litre into grains per ounce.—Multiply the grammes by 0·44.

C.c.s. per litre into minims per ounce.—Divide the c.c.s. by 2 (more exactly, multiply by 0·48).

Grains per ounce into grammes per litre.—Multiply the grains by 2·3. Thus 50 grs. per oz. = 115 gms. per litre.

Minims per ounce into c.c.s. per litre.—Multiply the minims by 2.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., 436 $^4/_{11}$ grains for every 5s. Thus the threepenny bit is 21·8 grs.; a sixpence, 43·6; shilling, 87·2; florin, 175·4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—Three pennies, or five halfpennies, or ten farthings = 1 oz. (avoirdupois).

i.e., the penny = 145·8 grs.; 1 halfpenny, 87·5; and 1 farthing, 43·75 grs.

One sovereign weighs 123·27 grs.; the half-sovereign, 61·63 grs.

¼ oz. (avoir.)	= one-halfpenny and one threepenny piece.
½ " "	= two halfpennies and a farthing.
1 " "	= three pennies (or five halfpennies).
2 " "	= six pennies (or ten halfpennies).
4 " "	= twelve pennies (or twenty halfpennies).

FRENCH COINS AS METRIC WEIGHTS.

Lord Crawford gives the following table:—

	Silver Coins.		Bronze Coins.
25 gms... ..	5 francs	10 gms. ..	10 centimes
10 "	2 "	5 " ..	5 "
5 "	1 "	2 " ..	2 "
2½ "	½ " or 50 centimes	1 " ..	1 "

PARTS.

Formulæ given, as many are, in "parts," may be made up by writing gms. for the solid and c.c.s. for the fluid "parts," and converting them into the British measures by any of the tables in this section. Thus: Adurol, 10 parts; sodium sulphite, 100 parts; water 1000 parts becomes adurol, 154 grs.; sodium sulphite, 3 ozs. 230 grs. water, 35 ozs.

INCHES INTO MILLIMETRES.

Inches.	Millimetres.	Inches.	Millimetres.
1	25·4	3/8	9·5
15/16	23·8	11/32	8·7
9/10	23·0	5/16	7·9
7/8	22·2	9/32	7·1
13/16	20·6	1/4	6·4
3/4	19·1	7/32	5·6
11/16	17·5	3/16	4·8
5/8	15·9	1/8	3·2
9/16	14·3	3/32	2·4
1/2	12·7	1/16	1·6
7/16	11·1	1/32	0·8

MILLIMETRES INTO INCHES.

Millimetres.	Inches.	Millimetres.	Inches.
0·1	0·0039	13	0·51
0·5	0·015	14	0·55
1	0·04	15	0·59
2	0·08	16	0·63
3	0·12	17	0·67
4	0·16	18	0·71
5	0·20	19	0·75
6	0·24	20	0·79
7	0 28	21	0·83
8	0·31	22	0·87
9	0·53	23	0·90
10	0 39	24	0·94
11	0·43	25	0·98
12	0·47	25·4	1·0

ENGLISH SIZES OF PLATES.

Inches.	Cm.	Inches.	Cm.
3½ × 2½	8·9 × 6·4	7 × 5[5]	17·8 × 12·7
3¼ × 3¼[1]	8·25 × 8·25	8½ × 6½[6]	21·5 × 16·5
4¼ × 3¼[2]	10·8 × 8·25	10 × 8	25·4 × 20·3
5 × 4[3]	12·7 × 10·1	12 × 10	30·4 × 25·4
6½ × 4¾[4]	16·5 × 12·0	15 × 12	38·1 × 30·4

[1] Lantern plate. [2] Quarter-plate. [3] Smallest common size in America. [4] Half-plate. [5] Usual medium size in America. [6] Whole-plate.

CONTINENTAL SIZES OF PLATES IN COMMON USE.

Cm.	Inches.	Cm.	Inches.
4·5 × 6·0*	1¾ × 2⅜	13 × 21	5·12 × 8 25
9 × 12†	3·54 × 4·72	18 × 24	7 08 × 9·44
12 × 16	4·72 × 6·30	24 × 30	9·44 × 11·81
13 × 18‡	5·12 × 7·08	30 × 40	11·81 × 15·75

* Standard size of vest pocket plate camera.
† The standard small size, equivalent to the British quarter-plate.
‡ The standard medium size (British half-plate).

Foreign Lantern Slides.

The standard French size for lantern slides is 10 by 8 cm., though many makers prepare slides 3¼ by 3¼. The American size is 4 by 3¼, though some makers use the English quarter-plate (4¼ by 3¼).

CHEMICAL TABLES.

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page 929.

Name.	Symbol.	Equiv. Weight
Acetone	$C_3 H_6 O$	58
,, sulphite	$C_3 H_6 OH SO_3 Na$	162
Acid, acetic	$C_2 H_4 O_2$	60
,, benzoic	$C_6 H_5 COOH$	122
,, boric	$H_3 BO_3$	62
,, carbolic	$C_6 H_5 OH$	94
,, chlorochromic	$Cl Cr O_2 OH$	136·5
,, chromic (anhydride)	$Cr O_3$	100
,, citric	$C_6 H_8 O_7 H_2O$	210
,, dithionic	$H_2 S_2 O_6$	162
,, formic	$H_2 CO_2$	46
,, gallic	$C_6 H_2 (OH)_3 COOH H_2 O$	188
,, hydrobromic	$H Br$	81
,, hydrochloric	$H Cl$	36·5
,, hydrofluoric	$H F$	34
,, lactic	$CH_3 CH (OH) COOH$	90
,, nitric	HNO_3	63
,, oxalic	$H_2 C_2 O_4$	126
,, pentathionic	$H_2 S_5 O_6$	258
,, perchromic	$H Cr O_4$	117
,, phosphoric	$H_3 PO_4$	98
,, picric	$C_6 H_2 (NO_2)_3 OH$	139
,, pyrogallic	$C_6 H_3 (OH)_3$	126
,, salicylic	$C_6 H_4 (OH) COOH$	138
,, sulphuric	$H_2 SO_4$	98
,, sulphurous	$H_2 SO_3$	82
,, tannic	$C_{14} H_{10} O_9$	322
,, tartaric	$C_2 H_2 (OH)_2 (COOH)_2$	150
,, tetrathionic	$H_2 S_4 O_6$	225
,, trithionic	$H_2 S_3 O_6$	194
Adurol*	$C_6 H_3 (OH)_2 Cl$ (or Br)	—
Alcohol (methyl)	$CH_3 OH$	32
,, (ethyl)	$C_2 H_5 OH$	46

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Alum, ammonia	$Al_2\ (NH_4)_2\ (SO_4)_4\ 24H_2O$	906
„ chrome	$Cr_2\ K_2\ (SO_4)_4\ 24H_2O$	998
„ iron ammonia	$Fe_2\ (NH_4)_2\ (SO_4)_4\ 24H_2O$	964
„ potash	$Al_2\ K_2\ (SO_4)_4\ 24H_2O$	948
Aluminium chloride	$Al_2\ Cl_6\ 12H_2O$	267
„ sulphate	$Al_2\ (SO_4)_3\ 16H_2O$	634
„ sulphocyanide	$Al_2\ (CNS)_6$	402
Amidol	$C_6\ H_3\ OH\ (NH_2)_2{\cdot}2HCl$	197
Ammonia	NH_3	17
Ammonium bichromate	$(NH_4)_2\ Cr_2\ O_7$	252
„ bromide	$NH_4\ Br$	98
„ carbonate	$NH_4\ HCO_3 + NH_2\ COOH\ NH_4$	—
„ chloride	$NH_4\ Cl$	53·5
„ chromate	$(NH_4)_2\ Cr\ O_4$	152
„ citrate	$(NH_4)_2\ C_6\ H_6\ O_7$	226
„ iodide	$NH_4\ I$	145
„ molybdate	$(NH_4)_6\ Mo_7\ O_{24}\ 4H_2O$	1236
„ nitrate	$NH_4\ NO_3$	80
„ oxalate	$(NH_4)_2\ C_2O_4\ H_2O$	142
„ persulphate	$(NH_4)_2\ S_2\ O_8$	228
„ phosphate	$(NH_4)_2\ HPO_4$	132
„ sulphate	$(NH_4)_2\ SO_4$	132
„ sulphide	$NH_4\ HS$	51
„ sulphocyanide	$NH_4\ CNS$	76
„ vanadate	$NH_4\ VO_3$	117
Amyl, acetate	$C_7\ H_{14}\ O_2$	130
„ alcohol	$(CH_3)_2\ CH\ CH_2\ CH_2OH$	88
Anilin[illegible]	$C_6\ H_5\ NH_2$	93
Antimony, sulphide	$Sb_2\ S_3$	336
Aurantia	$(C_6H_2(NO_2)_3)_2\ N\ NH_4$	456
Aurine	$C\ (C_6\ H_4\ OH)_2\ C_6\ H_4\ O$	290
Barium, bromide	$Ba\ Br_2\ 2H_2O$	333
„ chloride	$Ba\ Cl_2\ 2H_2O$	244
„ iodide	$Ba\ I_2$	391
„ nitrate	$Ba\ (NO_3)_2$	261
„ peroxide	BaO_2	201
„ sulphate	$Ba\ SO_4$	233
Benzole (benzene)	$C_6\ H_6$	78
Borax (*see* Sodium borate)		
Bromine	Br	80
Cadmium, bromide	$Cd\ Br_2\ 4H_2O$	344
„ chloride	$Cd\ Cl_2$	183
„ iodide	$Cd\ I_2$	366
Calcium, carbide	$Ca\ C_2$	64
„ carbonate	$Ca\ CO_3$	100
„ chloride (cryst.)	$Ca\ Cl_2\ 6H_2O$	219

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Calcium, chloride (fused)	$Ca\,Cl_2$	111
„ hypochlorite	$Ca\,(O\,Cl)_2$	153
„ sulphate	$Ca\,SO_4\,2H_2O$	172
„ hydroxide (slaked lime)	$Ca\,(OH)_2$	74
Carbon, bisulphide	$C\,S_2$	76
Celloidin	$C_{12}\,H_{16}\,O_6\,(NO_3)_4$	504
Ceric, sulphate	$Ce\,(SO_4)_2\,4H_2O$	404
Chloral hydrate	$C\,Cl_3\,CH\,(OH)_2$	165·5
Chloroform	$CH\,Cl_3$	119·5
Chrysoidine	$C_6\,H_5\,N_2\,C_6\,H_3\,(NH_2)_2$	211·7
Cobalt, chloride	$Co\,Cl_2\,6H_2O$	238
Copper, bromide	$Cu\,Br_2$	223·5
„ chloride	$Cu\,Cl_2\,2H_2O$	170·5
„ nitrate	$Cu\,(NO_3)_2\,6H_2O$	357·5
„ sulphate	$Cu\,SO_4\,5H_2O$	249·5
Cyanine	$C_{29}\,H_{35}\,N_2\,I$	544
Dextrine	$(C_6\,H_{10}\,O_5)\,x$	—
Diamidophenol	$C_6\,H_3\,OH\,(NH_2)_2$	124
Edinol*		
Eikonogen†	$C_{10}\,H_5\,(OH)\,NH_2\,SO_2\,O\,Na$	263
Eosine	Na or K Salt of	—
	$C_6H_4(CO)_2O(C_6H\,OH\,X‡)_2$	—
Erythrosine	$C_6\,H_4\,(CO)_2\;O\;(C_6\;H\;OH\;X_2‡)_2$	—
Ether	$C_4\,H_{10}\,O$	74
Ferrous and ferric salts (See Iron)		
Formaline	40 % sol. of CH_2O	—
Glycerine	$C_3\,H_5\,(OH)_3$	92
Glycin§	$C_6\,H_4\,OH\,NHCH_2\,COOH$	167
Gold, chloride yellow	$H\,Au\,Cl_4\,4H_2O$	412
„ „ brown	$H\,Au\,Cl_4$	340
„ „ potassium	$K\,Au\,Cl_4\,2H_2O$	414
„ „ sodium	$Na\,Au\,Cl_4\,2H_2O$	398
Hydrogen, peroxide	H_2O_2	34
Hydroquinone	$C_6\,H_4\,(OH)_2$	110
Iodine	I	127
Iridious chloride	$Ir\,Cl_3$	299·5
„ tetrachloride	$Ir\,Cl_4$	335
„ potassium „	$K_2\,Ir\,Cl_6$	484
„ sodium „	$Na_2\,Ir\,Cl_6$	452
Iron.		
Ferric chloride (dry)	$Fe_2\,Cl_6$	325

* Edinol is the hydrochloride of γ-amido-oxy-benzyl-alcohol.

† Eikonogen is the sodium salt of amido- β-naphthol- β-monosulphuric acid.

‡ The X in these formulæ may be bromine, iodine, or chlo
in other proportions constitute the various commercial dyes.

§ Glycin is γ-oxyphenyl-glycin or γ-oxyphenyl-amido-acetic acid.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Ferric chloride (lump)	$Fe_2\ Cl_6\ 12H_2O$	541
,, ammonia citrate, brown	$4\ Fe\ C_6\ H_5\ O_7\ 3\ (NH_4)_3\ C_6H_5O_7\ 3\ Fe\ (OH)_3$	2030
,, ,, ,, green	$5\ Fe\ C_6H_5O_7\ 2(NH_4)_3\ C_6H_5O_7\ NH_4C_6H_7O_7\ 2H_2O$	1956
,, oxalate	$Fe_2\ (C_2\ O_4)_3$	376
,, ammonium oxalate	$(NH_4)_3\ Fe\ (C_2\ O_4)_3 3H_2O$	428
,, potassium ,,	$K_3\ Fe\ (C_2\ O_4)_3\ 3H_2O$	491
,, sodium ,,	$Na_6\ Fe\ (C_2O_4)_6\ 11H_2O$	976
Ferrous, chloride (dry)	$Fe\ Cl_2$	127
,, ,, (cryst.)	$Fe\ Cl_2\ 4H_2O$	199
,, oxalate	$Fe\ C_2\ O_4\ 2H_2O$	180
,, potassium oxalate	$K_2\ Fe\ (C_2\ O_4)_2H_2O$	328
,, sulphate	$Fe\ SO_4\ 7H_2O$	278
,, ammonia sulphate	$Fe\ (NH_4)_2\ (SO_4)_2\ 6H_2O$	392
Lead, acetate	$Pb\ (C_2\ H_3\ O_2)_2\ 3H_2O$	379
,, nitrate	$Pb\ (NO_3)_2$	331
Lithia, caustic	$Li\ OH$	24
Lithium, bromide	$Li\ Br$	87
,, carbonate	$Li_2\ CO_3$	74
Lithium, chloride	$Li\ Cl$ (cryst. has $2H_2O$)	42·5
,, iodide	$Li\ I$	134
Magnesium, chloride	$Mg\ Cl_2$	95
,, sulphate	$Mg\ SO_4\ 7H_2O$	246
Manganese, peroxide	$Mn\ O_2$	87
,, sulphate	$Mn\ SO_4\ 4H_2O$	225
Mercury	Hg	200
,, bichloride	$Hg\ Cl_2$	271
,, iodide	$Hg\ I_2$	454
,, potass. iodide (sol.)	$HgI_2{\cdot}2KI$	786
Metol*	$(C_6H_4OH\ NHCH_3p)_2\ H_2SO_4$	344
Ortol†	$(C_6H_4OH\ NHCH_3p) + C_6H_4\ (OH)_2p$	234
Palladious chloride	$Pd\ Cl_2$	177
,, potassium chloride	$K_2\ Pd\ Cl_4$	326
Para-amidophenol	$C_6\ H_4\ NH_2\ OH$	109
Phenol (see Acid carbolic)		
Platinum per (or bi)chloride	$H_2\ Pt\ Cl_6\ 6H_2O$	516·4
Potassium, ammonium chromate	$K\ NH_4\ Cr\ O_4$	173
,, bicarbonate	$K\ H\ CO_3$	100
,, bichromate	$K_2\ Cr_2O_7$	294
,, boro-tartrate	$C_2\ H_2\ (OH)_2\ (CO_2)_2\ BOK$	214
,, bromide	$K\ Br$	119
,, carbonate (dry)	$K_2\ CO_3$	138

* Metol is the sulphate of mono-methyl-para-amido phenol.
† Ortol is a mixture of one molecule each of methyl-ortho-amido-phenol and hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

Name.	Symbol.	Equiv. Weight.
Potassium chlorate	$K\ Cl\ O_3$	122·5
" chloride	$K\ Cl$	74·5
" chloro-platinite	$K_2Pt\ Cl_4$	413·4
" chromate	$K_2\ Cr\ O_4$	194
" citrate	$K_3\ C_6\ H_5\ O_7\ H_2O$	342
" cyanide	$K\ C\ N$	65
" ferricyanide	$K_3\ Fe\ (CN)_6$	329
" ferrocyanide	$K_4\ Fe\ (CN)_6\ 3H_2O$	422
" hydrate	$K\ HO$	56
" iodide	$K\ I$	166
" metabisulphite	$K_2\ S_2\ O_5$	222
" nitrate	$K\ NO_3$	101
" nitrite	$K\ NO_2$	85
" oxalate	$K_2\ C_2\ O_4\ H_2O$	184
" percarbonate	$K_2\ C_2\ O_6$	198
" perchlorate	$K\ Cl\ O_4$	138·5
" permanganate	$K_2\ Mn_2O_8$	316
" persulphate	$K_2\ S_2\ O_8$	270
" sulphate	K_2SO_4	174
" sulphocyanide	$K\ C\ N\ S$	97
Pyrocatechin	$C_6\ H_4\ (OH)_2$	110
Rochelle salt	$K\ Na\ C_4\ H_4\ O_6\ 4H_2O$	282
Schlippe's salt (sodium sulphantimoniate)	$Na_3\ Sb\ S_4\ 9H_2O$	479
Silver, acetate	$Ag\ C_2\ H_3\ O_2$	167
" ammonium nitrate	$Ag\ NO_3+2NH_3$	204
" bromide	$Ag\ Br$	188
" carbonate	$Ag_2\ CO_3$	276
" chloride	$Ag\ Cl$	143·5
" citrate	$Ag\ C_6\ H_5\ O_7$	513
" fluoride	$Ag\ F\ 4H_2O$	199
" iodide	$Ag\ I$	235
" nitrate	$Ag\ NO_3$	170
" nitrite	$Ag\ NO_2$	154
" oxalate	$Ag_2\ C_2\ O_4$	304
" oxide	$Ag_2\ O$	224
" phosphate	$Ag_3\ PO_4$	419
" sulphate	$Ag_2\ SO_4$	312
" sulphide	$Ag_2\ S$	248
" tartrate	$Ag_2\ C_4\ H_4\ O_6$	363·4
Sodium, acetate	$Na\ C_2\ H_3\ O_2\ 3H_2O$	136
" " (fused)	$Na\ C_2\ H_3\ O_2$	102
" bicarbonate	$Na\ H\ CO_3$	84
" bichromate	$Na_2\ Cr_2\ O_7\ 2H_2O$	298
" bisulphite	$Na\ H\ SO_3$	104

TABLES OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Sodium, borate	$Na_2\ B_4\ O_7\ 10H_2O$	382
" bromide	$Na\ Br\ 2H_2O$	139
" carbonate (dry)	$Na_2\ CO_3$	106
" carbonate (cryst.)	$Na_2\ CO_3\ 10H_2O$	286
" chloride	$Na\ Cl$	58·5
" chloro-platinate	$Na_2\ Pt\ Cl_6\ 6H_2O$	560·4
" citrate	$Na_3\ C_6\ H_5\ O_7\ 5\frac{1}{2}H_2O$	357
" fluoride	$Na\ F$	42
" hydrate (caustic)	$Na\ OH$	40
" hydrosulphite*	$Na\ H\ SO_2$	88
" hyposulphite†	$Na_2\ S_2\ O_3\ 5H_2O$	248
" iodide	$Na\ I$	150
" nitrate	$Na\ NO_3$	85
" nitro-prusside	$Na_4\ Fe_2\ (CN)_{10}\ (NO)_2\ 4H_2O$.	600
" oxalate	$Na_2\ C_2\ O_4$	134
" phosphate	$Na_2HPO_4\ 12H_2O$	358
" tribasic phosphate	$Na_3PO_4\ 12H_2O$	380
" sulphate (cryst.)	$Na_2\ SO_4\cdot 10H_2O$	322
" sulphide	$Na_2\ S\ 9H_2O$	240
" sulphite (dry)	$Na_2\ SO_3$	126
" " (cryst.)	$Na_2\ SO_3\ 7H_2O$	252
" tungstate	$Na_{10}\ W_{12}\ O_{41}\ 28H_2O$	3598
Strontium, bromide	$Sr\ Br_2$	247·5
" chloride (dry)	$Sr\ Cl_2$	158·5
" " (cryst.)	$Sr\ Cl_2\ 2H_2O$	194·5
" iodide	$Sr\ I_2$	341·5
" nitrate	$Sr\ (NO_3)_2$	211·5
Thiocarbamide	$CS\ (NH_2)_2$	76
Thiosinamine	$CS\ (NH_2)\ NH\ C_3\ H_5$	116
Thymol	$CH_3\ C_6\ H_3\ OH\ C_3\ H_7$	150
Tin (Stannous) chloride	$Sn\ Cl_2 + 2H_2O$	225
Uranium, acetate	$UO_2\ (C_2\ H_3\ O_2)_2\ 2H_2O$	426
" chloride	UO_2Cl_2	343
" nitrate	$UO_2\ (NO_3)_2\ 6H_2O$	504
Zinc, sulphate	$Zn\ SO_4\ 7H_2O$	287

* Called "hyposulphite" by chemists. † Called "thiosulphate" by chemists

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol.=*soluble*; v.s.=*very soluble*; s.s.=*slightly soluble*; dec.=*decomposed*; insol.=*insoluble*.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcoh &c.
Acetone	..	..	..	
,, sulphite	v.s.	..	..	s.s.
Acid, acetic	..	..	..	
,, benzoic	380	45	0·27	1 in 2·75 90%
,, boric	29	2·9	3½	1 in 28 90%
,, carbolic	15	..	6·6	v.s.
,, chromic (anhydride)	0·6	v.s.	160	sol. with decomp
,, citric	¾	½	130	
,, formic	..	..	..	

Acetone.—(Sp. gr. 0·814), boils at 133°F. miscible in all proportions with water, alcohol and ether. 272 gms. dissolve in 100 gms. 20% cane sugar solution at 60° F. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The "glacial" acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50°. Its sp. gr. is 1·055; it boils at 245°F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1·22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1·20 (90%); 1·18 (80%); 1·15 (65%); 1·12 (50%) and 1·06 (25%).

Hydriodic Acid.—A solution of the gas, HI, and obtainable as strong as sp. gr. 2·0 (=96% HI). Solution of sp. gr. 1.7 contains about 52%; sp. gr. 1.5, about 43%.

Hydrobromic Acid.—A solution of the gas, HBr., in water. The strongest solution has sp. gr. of 1·78 (=82%); sol. of 1·495 sp. gr. contains 48% HBr.; 1·38, 40%; 1·208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl, in water. The commercial strongest acid has sp. gr. 1·16, and contains about 30% HCl. Impure acid is sold as "spirits of salts."

Hydrocyanic Acid (=Prussic Acid).—The strength of the official acid of the British Pharmacopœia is 2%. A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric Acid is a strongly fuming solution of the gas HF.; it is sold of strengths 40% and 55% HF.

Lactic Acid is sold as a colourless syrupy liquid, miscible with water or alcohol, Sp. gr. 1·21. A weaker acid is also sold commercially containing 50% acid.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Acid gallic	100	0·3	1	1 in 5 90% alcohol 1 in 40 ether
,, oxalic	9·5	0·3	10½	
,, picric	100	..	1	1 in 10 90%, also in ether
,, pyrogallic	2¼	v.s.	44	sol. also in ether, not in chloroform
,, salicylic	500	12½	⅕	1 in 3 5, 1 in 2 in ether
,, tannic	0·5	..	20	1 in 0·6, nearly insol. in ether
,, tartaric	¾	¼	132	
Alum, ammonia	8·3	0·24	12	insoluble
,, chrome	6	dec.	16	
,, iron ammonia	3	dec.	33	insoluble
,, potash	10	v.s.	9 6	insoluble
Aluminium, chloride	¼	v s.	400	soluble
,, sulphate	3	1·1	35	
Amidol	4	v.s.	24	less sol. in alc. & eth.
Ammonium, bichromate	5	¼	20	1 in 31 absolute alc.
,, bromide	1·4	v.s.	72	

Nitric Acid.—Strongly corrosive liquid of 1·42 sp. gr. (=71% HNO_3); soluble in water; oxidises alcohol and other organic solvents.

Phosphoric Acid.—Sold as syrupy liquid, that of 1·75 sp. gr. (=about 90% acid), being intended when "phosphoric acid" is prescribed in formulæ.

Sulphuric Acid.—The commercial strong acid is a thick corrosive liquid of 1·84 sp. gr. (=98% H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water—not *vice versa.*

Sulphurous Acid.—Solution in water of the gas SO_2; saturated solution of 1·046 is equivalent to 9·5% H_2SO_3, but soon loses strength.

Albumen.—On heating the cold solution to 160°F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. 0·814).—The chief constituent of crude "wood spirit," or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms "absolute alcohol" (sp. gr. 0·830 to 0·834), which contains from 2 to 5% water. Alcohol containing 16% water is "rectified spirit." "Methylated" spirit consists of rectified spirit *plus* 10% crude wood spirit and ½% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

Aluminium Chloride.—100 gms. saturated solution (sp. gr., 1·35) contains 41·1 gms. aluminium chloride.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Ammonium carbonate ..	4	dec.	25	
" chloride	3	1·4	35	
" citrate	½	v.s.	200	
" iodide	0 6	v.s.	165	1 in 4 alc., s.s in ether
" molybdate .	2½	dec.	40	
, nitrate	½	v.s.	200	
" oxalate	23	2·4	4·3	sol.
" persulphate	1½	dec.	65	
" sulphocyanide	0·6	v.s.	160	v.s.
" vanadate	s.s.	v.s.	..	
Antimony sulphide	insol.	..	..	
Aurantia	s.s.	..	..	v.s.; s.s. in ether
Aurine	s s.	..	..	sol.; also in ether
Barium bromide	0·75	0·5	133	v.s. in benzole
" chloride	2·4	1·3	42	insol.
" iodide	½	v.s.	200	1 in 20 alcohol
" nitrate..........	12	3·1	8	insol.
Bromine................	31	..	3·2	
Cadmium, bromide	0·94	v.s.	106	1 in 3 alc; 1 in 250 eth.
,, ammonium bromide	0·7	v.s.	137	
" chloride	0·71	0·67	140	1 in 8 alcohol
" iodide	1·08	0·75	93	1 in 1 alc.; 1 in 3 6 eth.
Calcium, chloride (cryst.)	½	v.s.	400	
" " (fused)	1·4	0·65	70	
" sulphate	380	450	0·3	
" hydroxide	700	1,300	0·137	
Ceric sulphate	12	200	8·3	
Chloral hydrate	¼	..	400	1 in 1/5 90%, 1 in 50 carbon bisulphide.
Copper bromide	v.s	v.s.	..	
,, chloride	0·83	v.s.	121	v.s.; also in ether.
,, sulphate	2½	½	40	
Cyanine................	s.s.	..	..	
Diamidophenol	sol.	..	..	

Aluminium Sulphocyanide is purchased as a reddish solution of 1·16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also polysulphides.

Amyl Acetate.—Liquid of sp. gr. 0·876, miscible with alcohol and ether but not with water. A solvent of fats, oils, resin, pyroxyline and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water

Aniline (sp. gr. 1·036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling.		
Edinol	sol.	..	..	[cohol or ether.
Eikonogen	25	..	4.2	nearly insol. in al-
Eosine	sol.	..	..	insol. in ether.
Ether	12	..	8	
Erythrosine	s.s.	..	..	s.s.
Gold, chloride	v.s.	v.s.	..	
Hydroquinone	17	..	6	
Iodine	insol.	insol.	..	sol.; also in carbon bisulphide
Iron				
Ferric chloride (lump)	v.s.	v.s.	..	
,, ,, (dry)	0·63	v.s.	160	
,, ammonium citrate	4	..	25	
(brown)*	..	..	..	
,, ,, (green)†	..	..	..	
,, ammonium oxalate	2·1	..	0·48	
,, potassium ,,	15	0·85	6·6	insol.
,, sodium ,,	1·69	0·55	60	
Ferrous chloride (dry)	2	v.s.	50	
,, ,, (cryst.)	0·68	v.s.	147	
,, oxalate	4500	3800	..	
,, sulphate§	1·43	0 27	70	
,, am. sulphate§	3	..	33	
Lead, acetate	1½	0·5	66	1 in 15 alcohol;
Lead, nitrate	2	0·7	50	insol. in ether.
Lithia, caustic	s.s.	..	..	
Lithium, bromide	0·7	0·4	143	
,, carbonate	72	138	1·3	v.s.
,, chloride	1¼	0·8	80	
,, iodide	0·61	0·2	164	v.s.
Magnesium, chloride (dry)	1·7	1½	60	v.s.
,, sulphate	1	0·15	100	
Manganese, sulphate	0·8	1	120	

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F., sp. gr. 0·722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH_2O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolved in the cold by oxalic, acetic, hydrochloric, or nitric acid, barium chloride or chloral hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1·265.

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution.

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212° F.

§ Seven parts of ferrous sulphate correspond to 10 parts ferrous ammonium sulphate. * 21·7 to 22·4% iron. † 14 to 15% iron.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in —parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Mercury, bichloride	16	1·8	6·3	insol. in absolute alc.
" iodide	150	..	0·66	1 in 4 90%
Metol	sol.	..	..	
Ortol	sol.	..	..	s.s.; also in ether
Para-amido-phenol hydrochloride	10	..	10	1 in 22
Phenol (*see* acid carbolic)				
Potassium, bicarbonate	4	dec.	25	
" bichromate	10	1	10	
" borotartrate	¾	v.s.	135	
" bromide	1¼	1	65	
" carbonate (dry)	0·9	0·64	112	1 in 750
" chlorate	17	2	6	insol.
" chloride	3	1·75	33	insol.
" chloroplatinite	6	v.s.	17	
" chromate	2	1·2	50	insol.
" citrate	0·6	v.s.	166	insol.
" cyanide	0·8	v.s.	122	v.s.
" ferricyanide	2½	1·3	40	1 in 9
" ferrocyanide	3·4	2	29	
" hydrate	½	v.s.	200	insol.; insol. in eth.
" iodide	0·7	½	140	sol.
" metabisulphite	sol.	dec.	..	1 in 16, 90%
" nitrate	3½	0·4	28	
" nitrite	1	v.s.	100	
" oxalate	3	v.s.	33	insol.
" percarbonate	15	dec.	6·5	
" perchlorate	100	5	1	
" permanganate	16	..	6·25	
" persulphate	50	dec.	2	
" sulphocyanide	0·46	v.s.	220	insol. in absolute alc.
" acid sulphate	2	0·8	50	
Pyrocatechin	1¼	v.s.	80	
Rochelle salt	1½	v.s.	66	
Schlippe's salt	3	v.s.	33	
Silver, acetate	100	..	1	
" carbonate	insol.	..	..	
" chlorate	5	2	20	
" citrate[1]	insol.	..	..	
" cyanide	insol.	..	..	
" fluoride[2]	v.s.	v.s.	..	

1. Readily soluble in ammonia and hypo.
2. $AgF.4H_2O$ is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Silver, nitrate	0·44	0·1	227	1 in 26, 90%
,, nitrite	s.s.	..	..	
,, sulphate	87	..	1·15	
,, sulphocyanide	insol.	..	..	
,, tartrate	insol.	..	..	
Sodium, acetate	2·8	v.s.	36	1 in 50, 90%; insol. in ether
,, bicarbonate	11·3	dec.	8·8	
,, bichromate	1	0·6	100	
,, bisulphite	v.s.	..	..	
,, borate	12½	½	8	
,, bromide	1·1	0·9	90	1 in 15
,, carbonate (dry)	6	2·2	16·2	
,, ,, (cryst.)	1·56	v.s.	63·2	
,, chloride	3	2½	35	
,, chloroplatinate	sol.	..	..	
,, citrate	sol.	..	..	s.s.
,, fluoride	25	..	4	
,, hydrate (caustic)	v.s.	v.s.	..	
,, hyposulphite	0·6	v.s.	170	insol.
,, iodide	0·6	0·4	166	
,, nitrate	1·1	0·6	85	
,, oxalate	35	..	3	
,, phosphate	6·7	1	15	
,, sulphide	v.s.	v.s.	..	
,, sulphite (cryst)	2·2	1	45	
,, ,, (dry)	4	..	25	
,, tri-basic phosphate	0·5	v.s.	20	
,, tungstate	8 to 12	..	..	insol.
,, (meta) vanadate	½	v.s.	200	
Strontium, bromide	1·01	½	100	1 in 30, 90%
,, chloride	1·96	1	51	
,, ,, (cryst.)	1·33	0·6	75	
,, iodide	0·56	0·25	18	
,, nitrate	1·41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether
Thiosinamine	17	..	6	1 in 2 90%; also in eth.
Thymol	330	..	0·3	1 in 3·75 90%; also in ether.
Tin (stannous), chloride	1½	v.s.	66	
Uranium, acetate	v.s.	v.s.	..	
,, chloride	v.s.	v.s.	..	
,, nitrate	½	v.s.	200	
Zinc, sulphate	0·62	0·15	161	

PERCENTAGE OF REAL AMMONIA IN SOLUTIONS OF DIFFERENT DENSITIES AT 14° CENTIGRADE.—CARIUS.

Specific Gravity.	Per-centage Ammonia	Specific Gravity.	Per-centage Ammonia	Specific Gravity.	Per-centage Ammonia	Specific Gravity.	Per-centage Ammonia
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9503	10·0	0·9959	1·0

INDICATORS

(I.e., Colour Tests for Alkalies and Acids).

	Acid.	Alkaline.	In presence of Carbon Dioxide.
Litmus	Bright red	Blue	Reddish purple
Cochineal	Yellow	Reddish violet	Not affected
Methyl orange ..	Red	Yellow brown	Not affected
Phenol-phthalein	Colourless	Intense red	Useless

Reaction of Substances to Various Indicators.

Substance.	Litmus.	Methyl Orange.	Phenol-phthalein.
Alum	acid	neutral	acid
Borax	alkaline	alkaline	neutral
Potass. metabisulphite	acid	neutral	acid
Potass. oxalate	neutral	neutral	neutral
Rochelle salt	neutral	neutral	neutral
Silver nitrate	acid	neutral	acid
Sodium bicarbonate	alkaline	alkaline	neutral
Sodium citrate	alkaline	alkaline	neutral
Sodium bisulphite	acid	neutral	acid
Sodium sulphite	alkaline	alkaline	neutral
Sodium phosphate	neutral	alkaline	neutral

Thermometric Rules.

The following rules for the rapid conversion of degrees in one system into another will be found useful:—

To Convert Centigrade into Fahrenheit:

Degrees Centigrade × 9 ÷ 5 + 32.

Ex.—80° C. × 9 ÷ 5 = 144 + 32 = 176° F.

To Convert Fahrenheit into Centigrade:

(Degrees Fahrenheit – 32) × 5 ÷ 9.

Ex.—100° F. – 32 = 68 × 5 ÷ 9 = 37·8 C.

To Convert Fahrenheit into Réaumur:

(Degrees Fahrenheit – 32) ÷ 9 × 4.

Ex.—95° F. – 32 = 63 ÷ 9 × 4 = 28° R.

To Convert Réaumur into Fahrenheit:

Degrees Réaumur × 9 ÷ 4 + 32.

Ex.—16° R. × 9 ÷ 4 = 36 + 32 = 68° F.

To Convert Centigrade into Réaumur:

Degrees Centigrade × 4 ÷ 5.

Ex.—60° C. × 4 ÷ 5 = 48° R.

To Convert Réaumur into Centigrade:

Degrees Réaumur × 5 ÷ 4.

Ex.—80° R. × 5 ÷ 4 = 100° C.

COMPARISON OF THERMOMETER SCALES.

Equivalence of Centigrade (Celsius) and Fahrenheit Thermometers.

Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
0	32·0	35	95·0	70	158·0
1	33·8	36	96·8	71	159·8
2	35·6	37	98·6	72	161·6
3	37·4	38	100·4	73	163·4
4	39·2	39	102·2	74	165·2
5	41·0	40	104·0	75	167·0
6	42·8	41	105·8	76	168·8
7	44·6	42	107·6	77	170·6
8	46·4	43	109·4	78	172·4
9	48·2	44	111·2	79	174·2
10	50·0	45	113·0	80	176·0
11	51·8	46	114·8	81	177·8
12	53·6	47	116·6	82	179·6
13	55·4	48	118·4	83	181·4
14	57·2	49	120·2	84	183·2
15	59·0	50	122·0	85	185·0
16	60·8	51	123·8	86	186·8
17	62·6	52	125·6	87	188·6
18	64·4	53	127·4	88	190·4
19	66·2	54	129·2	89	192·2
20	68·0	55	131·0	90	194·0
21	69·8	56	132·8	91	195·8
22	71·6	57	134·6	92	197·6
23	73·4	58	136·4	93	199·4
24	75·2	59	138·2	94	201·2
25	77·0	60	140·0	95	203·0
26	78·8	61	141·8	96	204·8
27	80·6	62	143·6	97	206·6
28	82·4	63	145·4	98	208·4
29	84·2	64	147·2	99	210·2
30	86·0	65	149·0	100	212·0
31	87·8	66	150·8	105	221·0
32	89·6	67	152·6	110	230·0
33	91·4	68	154·4	115	239·0
34	93·2	69	156·2	120	248·0

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Aluminium	Al	27	27·1
Antimony	Sb	120	120·2
Argon	A	40	39·9
Arsenic	As	75	75·0
Barium	Ba	137	137·43
Beryllium	Be = Gl	9·1	9·1
Bismuth	Bi	208	208·0
Boron	B	11	11·00
Bromine	Br	80	79·96
Cadmium	Cd	112	112·4
Cæsium	Cs	133	132·9
Calcium	Ca	40	40·1
Carbon	C	12	12·0
Cerium	Ce	140	140·25
Chlorine	Cl	35 5	35·451
Chromium	Cr	52	52·11
Cobalt	Co	59	59·00
Copper	Cu	63·5	63·60
Erbium	Er	166	166·0
Fluorine	F	19	19·0
Gadolinium	Gd	156	156·01
Gallium	Ga	70	70·0
Germanium	Ge	72·5	72·5
Gold	Au	197	197·2
Helium	He	4	4·0
Hydrogen	H	1	1·008
Indium	In	115	115·0
Iodine	I	127	126·97
Iridium	Ir	193	193 0
Iron	Fe	56	55·9
Lanthanum	La	139	138·9
Lead	Pb	207	206·92
Lithium	Li	7	7·03
Magnesium	Mg	24	24·36
Manganese	Mn	55	55·0
Mercury	Hg	200	200·0

A TABLE OF ATOMIC WEIGHTS—Continued.

Name.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Molybdenum	Mo	96	96·0
Neodymium	Nd	144	143·6
Nickel	Ni	59	58·70
Niobium	Nb=Cb	94	94·0
Nitrogen	N	14	14·04
Osmium	Os	191	191·0
Oxygen (Standard)	O	16	16·0
Palladium	Pd	106	106·5
Phosphorus	P	31	31·0
Platinum	Pt	193·4	194·8
Potassium	K	39	39·15
Praseodymium	Pr	141	140·5
Rhodium	Rh	103	103·0
Rubidium	Rb	85	85·5
Ruthenium	Ru	102	101·7
Samarium	Sm	150	150·3
Scandium	Sc	44	44·1
Selenium	Se	79	79·2
Silicon	Si	28	28·4
Silver	Ag	108	107·93
Sodium	Na	23	23·05
Strontium	Sr	87·5	87·6
Sulphur	S	32	32·06
Tantalum	Ta	183	183·0
Tellurium	Te	128	127·6
Terbium	Tb	160	160·0
Thallium	Tl	204	204·1
Thorium	Th	233	232·5
Thulium	Tu	171	171·0
Tin	Sn	118	119·0
Titanium	Ti	48	48·1
Tungsten	W	184	184·0
Uranium	U	240	238·5
Vanadium	V	51	51·4
Ytterbium	Yb	173	173·0
Yttrium	Yt	89	89·0
Zinc	Zn	65	65·4
Zirconium	Zr	91	90·6

TABLE OF POISONS AND ANTIDOTES. Compiled by J. Elsden.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid.	Oxalic Acid, including Potassium Oxalate	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies.	Ammonia Potash Soda	Vapour of ammonia may cause inflammation of the lungs	Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts.	Mercuric Chloride	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	Acetate of Lead	The sub-acetate is still more poisonous	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia. Emetic of sulphate of zinc.
	Cyanide of Potassium	*a.* Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	Bichromate of Potassium	*a.* Taken internally.	Irritant pain in stomach and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	Nitrate of Silver		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	Nitric Acid	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	Hydrochloric Acid	½ ounce has caused death.		
	Sulphuric Acid	1 drachm has been fatal.		
	Acetic Acid, concentrated, has as powerful an effect as the mineral acids.			
	Iodine	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel, arrowroot and starch given freely.
	Ether	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	Pyrogallic Acid	2 grains sufficient to kill a dog.	Resembles phosphorus poisoning.	No certain remedy. Speedy emetic desirable.

ORTHOCHROMATIC DATA.

DISTRIBUTION OF THE COLOURS IN THE SPECTRUM.

(According to Listing.)

		Wave length			Wave length.
Brown ..	Limit ..	819 8	Cyan Blue..	Limit ..	491·9
	Middle ..	768·6		Middle ..	473·0
Red.. ..	Limit ..	723·4	Indigo ..	Limit ..	455·5
	Middle ..	683·2		Middle ..	439·2
Orange ..	Limit ..	647·2	Violet ..	Limit ..	424·0
	Middle ..	614·9		Middle ..	409·9
Yellow ..	Limit ..	585·6	Lavender..	Limit ..	396·7
	Middle ..	559 0		Middle ..	384·3
Green ..	Limit ..	534·7		Limit ..	372·6
	Middle ..	512·4			

WAVE LENGTHS OF BRIGHT LINES OF ELEMENTS USED IN PLOTTING OUT THE SPECTRUM.

(In Ten-Millionths of a Millimetre Angstrom Units.)

Table I.

Name of line.	Colour.	Salts used.	Wave lengths = λ
Lithium	Red	Lithium chloride or nitrate ..	6705
Lithium	Orange	Lithium chloride or nitrate ..	6102
D	Orange	Sodium chloride or bicarbonate	5893
"Little b"	Green	Magnesium ribbon	5183
Strontium	Blue	Strontium chloride or metal ..	4607
Calcium	Blue	Calcium nitrate or chloride ..	4227
Potassium	Violet	Potassium chloride	4080

Table I. has been drawn up so as to enable any one with nothing more than an ordinary Bunsen gas burner to construct a chart, by means of which the position of any Fraunhofer line in the spectrum may be determined with sufficient accuracy for all photographic purposes. The salts should be dissolved in distilled water so as to form a saturated solution, a narrow loop of copper or iron wire should be wound with fibrous asbestos, and this repeatedly heated in the Bunsen and allowed to cool.

TABLE II.

C	Red	Hydrogen tube	6563
"Little b"	Green	Magnesium rod	5183
F	Bluish-green	Hydrogen tube	4861
Magnesium	Blue	Magnesium rod	4481
G	Blue	Hydrogen tube	4308
"Little h"	Blue	Hydrogen tube	4102

Table II. will give the data, most easily obtained if a small induction coil is used. A small coil, giving a fat ½ or ¾ in. spark, and actuated by three bichromate bottles will suffice to show the lines in this table. The hydrogen tube is, of course, of the well-known Plucker or Salet form. The magnesium may be used in twisted spirals of ribbon, but preferably in rod form, and the rods should be filed to comparatively sharp points. The constricted portion of the vacuum tube and the points of the magnesium rod should be placed parallel to and not at right angles to the slit.

EXPOSURE TABLES.

The following table, based on that of Burton, gives a rough idea of the exposures for various subjects and diaphragms under the following conditions:—

1. Best lighting; midday sunshine in May, June, and July.
2. With the most rapid commercial plates. See below for factors applying to other conditions.

F/ No.	Average Subject with objects in Foreground. Street Scenes. Outdoor Figure Studies.	Landscapes with Light Foreground, Lake, River, and Beach Scenes.	Sea Clouds and Sky.	Subjects with Extra Heavy Foreground, e.g., Dark Trees, Doorways, Groups.	Under Trees. Woods, Avenues, Glades, etc.	Portrait in Average Well-lighted Room.
f/4	1/250	1/500	—	1/120	1/20	1/8
f/4·5	1/200	1/400	—	1/100	1/15	1/7
f/5·6	1/130	1/250	—	1/64	1/10	1/4
f/6·3	1/100	1/200	1/1000	1/50	1/8	1/3
f/7	1/80	1/150	1/800	1/40	1/7	2/5
f/8	1/64	1/120	1/600	1/30	1/5	1/2
f/11	1/30	1/60	1/300	1/15	1/2	1
f/16	1/15	1/30	1/150	1/8	1	2
f/22	1/8	1/15	1/80	1/4	2	4
f/32	1/4	1/8	1/40	1/2	4	8
f/45	1/2	1/4	1/20	1	8	16
f/64	1	1/2	1/10	2	16	30

In weather other than bright sunshine the above exposures are multiplied as follows:—

Bright diffused light, the sun behind a cloud	× 1½	Heavy clouds over the whole sky. Absence of distinct shadows ..	× 3
Light clouds over the whole sky, but light able to cast a visible shadow	× 2	Very dull. Whole sky covered by still heavier clouds	× 4 to 5

At other hours of the day and times of the year the above exposures are multiplied by the numbers in the following table of daylight variation. The figure 1 in the table indicates times for which the above exposures are correct.

VARIATION IN DAYLIGHT FROM MORNING UNTIL EVENING (FOR LATITUDE OF BRITISH ISLES, NORTH GERMANY, ETC.).

	Morning.								
	12	11	10	9	8	7	6	5	4
January ..	3½	4	5	12					
February ..	2	2½	3	4	10				
March	1½	1½	1¾	2	3	6			
April	1¼	1¼	1¼	1½	2	3	6		
May	1	1	1	1¼	1½	2½	3	6	
June	1	1	1	1	1½	2	2½	5	12
July	1	1	1	1¼	1½	2½	3	6	
August	1¼	1¼	1¼	1½	2	3	6		
September ..	1½	1½	1¾	2	3	6			
October.. ..	2	2½	3	4	10				
November ..	3½	4	5	12					
December ..	4½	5	6						
	12	1	2	3	4	5	6	7	8
	Afternoon.								

PINHOLE EXPOSURES.

(WATKINS-POWER NUMBERS.*)

W.P. No.	Diameter.		Nearest Needle Size.	Good Working Distance.
	Inch.	Inch.		Inches.
1	0·160	$\frac{1}{6}$	—	—
2	0 080	$\frac{1}{13}$	—	—
3	0·053	$\frac{1}{19}$	1	40
4	0 040	$\frac{1}{25}$	4	20
5	0·032	$\frac{1}{31}$	5	14
6	0 027	$\frac{1}{38}$	7	10
7	0·023	$\frac{1}{44}$	8	8
8	0 020	$\frac{1}{52}$	10	5

Rule for use of W.P. No. in Column 1.—Multiply W.P. No. of aperture by its working distance from plate. Use the result as the f/No. in calculating exposure by meter, tables or other means. Whatever the calculated result is in seconds or fractions of a second, expose that number of minutes or fractions of a minute. Example.—W.P. 6 at 8 inches—calculate as f/48.

* The principle of this system will be understood from a consideration of an example of focal aperture:—A $\frac{1}{4}$-inch aperture at 9 inches = f/36 If every second on the actinometer is to be reckoned a minute, the aperture must be one-sixtieth the *area*, that is the diameter must be divided by $\sqrt{60}$ or, near enough, by $\sqrt{64} = 8$. Therefore, an aperture of $\frac{1}{4} \div 8 = \frac{1}{32}$ inch diameter = f/36 when minutes are given instead of seconds. Therefore, reasoning backwards, a pinhole of $\frac{1}{32}$-inch diameter is called No. 4 (32 ÷ 8). Similarly one of half the diameter is No 8, and so on. Mr. Watkins, in order to allow for the exposure in excess of the theoretical which is needed in pinhole photography, calculates minutes as seconds at $\frac{1}{40}$ instead of $\frac{1}{60}$, the *area* of aperture, and therefore his so-called W.P. (Watkins-Power number) is obtained by dividing the denominator of the fraction which expresses the diameter of the pinhole by 6·3 instead of 8. Thus, in the case of a $\frac{1}{38}$-diameter hole, 38 ÷ 6·3 = 6·2, or, near enough, W.P. No. is 6.

SHUTTER SPEEDS FOR MOVING OBJECTS.

From the "Wellcome Exposure Record and Diary."

The formula and table given below indicate the shutter speeds necessary to secure negatives sufficiently sharp for direct printing. For enlarging it is better to give ½ to ⅓ these exposures, or to work further from the object. *The figures are no guide to what is the correct exposure for the plate.*

If D = distance of object in feet, F = focal length of lens, S = speed of object in feet per second, and E = exposure for an object moving across the field of view, then

$$E = \frac{D}{100\,F \times S}$$

The following table gives in round figures the shutter speeds necessary for various moving objects, using the ordinary quarter plate lens of about 5 in. focus. The column A is for objects moving directly towards the operator, B for objects moving obliquely towards or from the camera, that marked C for objects moving directly across the field of view.

Distance of Object, 25 ft., unless otherwise stated.	A.	B.	C.
Street groups (no rapid motion)		1/5 to 1/10	
Pedestrians (two miles per hour) .. Animals grazing	1/20	1/40	1/60
Pedestrians (three miles per hour) ..	1/30	1/60	1/90
Pedestrians (four miles per hour).. ..	1/40	1/80	1/120
Vehicles (six miles per hour)	1/60	1/120	1/180
Vehicles (eight miles per hour)	1/80	1/150	1/250
Cyclists and trotting horses	1/160	1/300	1/500
Foot races and sports	1/240	1/500	1/700
Divers	—	1/600	1/800
Cycle races, horse galloping	1/300	1/750	1/900
Yachts (10 knots per hour) at 50 ft. ..	1/60	1/120	1/180
Steamers (20 knots per hour) at 50 ft. ..	1/120	1/240	1/360
Trains (30 miles per hour) at 50 ft. ..	1/150	1/300	1/450
Trains (60 miles per hour) at 50 ft. ..	1/300	1/600	1/900

At 50 ft. the exposure may be double that at 25 ft.
At 100 ft. the exposure may be double that at 50 ft.

OPTICAL CALCULATIONS.

FINDING THE FOCAL LENGTH OF A LENS.

As simple and accurate a method as any is first to focus the lens on an object at an infinite distance (see table on page 942), and to mark the position of any convenient part of the moving lens front on the fixed camera baseboard, then place any object such as a foot rule before the camera, and focus—by moving only (1) camera as a whole and (2) camera front on baseboard, not back of camera—until image on screen is same size as original. The distance through which the camera front has to be moved to secure this is the focal length of the lens, and is indicated by the separation of the mark on the fixed baseboard from that on the lens front in its final (same-size) position.

FOCAL DISTANCES WHEN COPYING ON A REDUCED SCALE.

When reducing an original x times (linear), distance from original to lens is found by *multiplying* focal length of lens by x and adding one focal length.

Example.—Reducing 12 in. to 4 in. (reduction of 3 linear) with 6 in. lens, distance from original to lens is $6\times 3+6=24$ in.

Distance from lens to plate is found by *dividing* focal length by x and adding one focal length.

Thus (conditions as above) $6\div 3+6=8$ in.

FOCAL DISTANCES WHEN ENLARGING WITH CAMERA OR LANTERN.

When enlarging a negative x times (linear), distance from negative to lens is found by *dividing* focal length of lens by x and adding one focal length.

Example.—4 inches in negative to 16 inches in enlargement, that is x equals 4. With lens of 8 inch focus, distance from lens to negative is $8\div 4+8=10$ in.

Distance from lens to sensitive paper or plate is found by *multiplying* focal length of lens by x and adding one focal length.

Thus (conditions as above) $8\times 4+8=40$ in.

"CONJUGATES" AND "EXTRA FOCAL" DISTANCES.

The full distances: (1) lens to plate, and (2) lens to original, are called the "conjugate focal lengths."

Imagine a solid bar projecting in front of and behind the lens to a distance in each case equal to the focal length of the lens. The

distances from opposite ends of the imaginary bar to the original and plate respectively are the "extra focal distances" (E.F.D.). They are the conjugates less one focal length.

MENTAL LENS CALCULATIONS.

By using the "extra focal distances" lens calculations become much more readily done in the head, remembering that:—

When copying or enlarging, say, 4 times, the greater "extra focal distance" is four times the focal length of the lens, and the smaller "extra focal distance" one-fourth the focal length of the lens. Similarly for a 5-times reduction or enlargement, the greater E.F.D. is five times the focal length; the smaller, one-fifth the focal length.

By adding one focal length to each of these E.F.D.'s we get the actual distances from plate and original to lens.

STUDIO CALCULATIONS.

(By the E.F.D. Method.)

To calculate what length of studio is necessary for work of a given kind with a given lens, it is convenient to take the height of the average sitter as:—

Full length standing .... 68 inches
Head and shoulders .... 30 inches

When making portraits in the sizes of prints in common use, the degrees of reduction are those given in the following table:—

Name and Size of Photograph.	C. de V.	Cabinet.	Boudoir.*	Imperial.†
Height of image on photograph	3	5	7½	9
For full-length portrait, reduction figure is	23	13	9	7½
For head and shoulders portrait, reduction figure is	10	6	4	3 nearly

* 8¼ × 5 † 10 × 6¾.

These few figures and the E.F.D. rule given above are all that is required for the ordinary studio calculations.

Thus we want to know what descriptions of work can be done, say, in a studio 18 ft. long with a 10 in. lens, that is we want to find the reduction figure possible in these conditions.

In all calculations of studio working space 6 ft. ought to be subtracted from the wall-to-wall length. The sitter will usually be 3 ft. in front of the back wall, and the photographer wants about the same space behind the camera.

Therefore, working space is 12 ft. = 144 in.

Subtracting 2 focal lengths (20 inches), the space for the two E.F.D.'s is 124 ins. As the smaller E.F.D. is only an inch or so (a fraction of the focal length), it is near enough to take this 124 ins. as the front E.F.D. Dividing it by the focal length,

$$124 \div 10 = 12\tfrac{1}{2},$$

we get the reduction figure, showing that the greatest reduction we can get is not quite enough for full length cabinets.

Similar studio calculations are readily made, bearing in mind that the total wall-to-wall length is parcelled out thus:—

E.F.D. towards object. (large).
E.F.D. towards image (small).
Two focal lengths.
Space for sitter and operator (6 ft.).

Remember, too, that the object E.F.D. is equal to the focal length × the reduction figure, whilst the image E.F.D. is the focal length ÷ the reduction figure, and is, therefore, never more than an inch or two at the most.

SHORTENING AND INCREASING THE FOCAL LENGTH OF A LENS.

The rule (very rough, on account of the impossibility of knowing from which part of a lens-mount to measure) for finding the focal length of an extra lens, to reduce or increase the focal length of a given lens, is:—

Multiply the focal length to be altered by the final focal length desired, and divide the product by the original focal length less the final focal length.

That is: $f_2 = \dfrac{f_1 \times F}{f_1 - F}$

where f_1 is the original focal length,
F the final focal length required,
and f_2 the focal length of the necessary added lens.

To increase the focal length use a negative lens.
To reduce the focal length use a positive lens.

MAGNIFIERS.

When using a supplementary lens (magnifier) as a means of bringing near objects into focus, the focal length of the supplementary lens must be equal to the distance of the object. This holds good whatever the focal length of the original lens.

TELEPHOTO CALCULATIONS.

F = equivalent focal length of complete lens.
f_1 = equivalent focal length of positive.
f_2 = equivalent focal length of negative.
E = camera extension, from negative lens to ground glass.
M = magnification, that is number of times the image given by the complete lens is larger than that given by positive alone.

Magnification when working at given extension is found by dividing camera extension by focal length of negative lens and adding 1.

$$M = \frac{E}{f_2} + 1.$$

Camera extension, necessary for given magnification—multiply focal length of negative lens by magnification less 1.

$$E = f_2\,(M-1)$$

Focal length of complete lens.—Multiply focal length of positive by magnification.

STEREOSCOPIC FACTS AND FIGURES.

To secure correct conditions of convergency each print must be seen under the same angle of view as that at which it was produced, and the two prints must be mounted in accord with the following rules:—

Let P = separation of any pair of corresponding points on prints.
N = separation of same points on negatives.
E = separation of eyes (average is 64 mm.).
L = separation of camera lenses.

A non-prismatic stereoscope being used:—

1. If image points represent infinitely distant objects, make $P = E$.

2. If only near objects are shown and an ordinary single plate double lens stereo camera has been used

Make $P = E + L - N$.

3. If a single camera is used for two separate exposures, or if two separate similar cameras are used together, measure N with negatives placed edge to edge and in the same relative positions that they occupied during exposure, and then

Make $P = E - N +$ length of one plate.

If a prismatic stereoscope, fitted with properly centred half lenses is used, add the width of one prism to above values of P.

DIAPHRAGM NUMBERS.

Equivalent F/- and Uniform System Numbers.

Rel. Exposure Req'd..	1	2	4	8	16	32	64	128
F Nos.	4	5·6	8	11·3	16	22·6	32	45·2
U.S. Nos.	1	2	4	8	16	32	64	128

Note.—Most lenses are now marked with the f/ numbers, although the U.S. numbers are used on Kodak lenses. Also the actual diameter of the diaphragm aperture in millimetres is marked on Zeiss lenses, such as the "Convertible."

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. Welborne Piper, from "The First Book of the Lens."

Focal Length, Inches.	Distance of Focussing-Screen behind Principal Focus.			
	$\frac{1}{100}$ in.	$\frac{1}{250}$ in.	$\frac{1}{500}$ in.	$\frac{1}{1000}$ in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11 ,,	28 ,,	55 ,,	110 ,,
3	25 ,,	63 ,,	125 ,,	250 ,
4	45 ,,	113 ,,	225 ,,	450 ,,
5	70 ,,	175 ,,	350 ,,	700 ,,
6	100 ,,	250 ,,	500 ,,	1000 ,,
7	136 ,,	340 ,,	680 ,,	1360 ,,
8	178 ,,	¼ mile	½ mile	1 mile
9¾	264 ,,	660 yds.	¾ ,,	1½ miles
11¼	351 ,,	½ mile	1 ,,	2 ,,
12½	434 ,,	1085 yds.	1¼ miles	2½ ,,
13¾	525 ,,	¾ mile	1½ ,,	3 ,,
16	700 ,,	1 ,,	2 ,,	4 ,,
17¾	875 ,,	1¼ miles	2½ ,,	5 ,,
19½	1056 ,,	1½ ,,	3 ,,	6 ,,
21	1225 ,,	1¾ ,,	3½ ,,	7 ,,
22½	1406 ,,	2 ,,	4 ,,	8 ,,
24	1600 ,,	2¼ ,,	4½ ,,	9 ,,
25	1 mile	2½ ,,	5 ,,	10 ,,
28	1¼ miles	3¼ ,,	6½ ,,	13 ,,
30	1½ ,,	3¾ ,,	7½ ,,	15 ,,
33	1¾ ,,	4½ ,,	9 ,,	18 ,,
35	2 ,,	5 ,,	10 ,,	20 ,,

By focussing accurately on distances not less than those given, we ensure that the focussing-screen is within $\frac{1}{100}$, $\frac{1}{250}$, $\frac{1}{500}$, or, $\frac{1}{1000}$ in. from the true principal focus.

DISTANCES WHEN ENLARGING AND REDUCING.

Focus of Lens, inches	TIMES OF ENLARGEMENT AND REDUCTION.							
	1	2	3	4	5	6	7	8
	inches	inches	inches	inches	inches	inches	inches	inches
3	6	9	12	15	18	21	24	27
	6	4 1/2	4	3 3/4	3 3/5	3 1/2	3 3/7	3 3/8
3 1/2	7	10 1/2	14	17 1/2	21	24 1/2	28	31 1/2
	7	5 1/4	4 2/3	4 3/8	4 1/5	4 1/12	4	3 15/16
4	8	12	16	20	24	28	32	36
	8	6	5 1/3	5	4 4/5	4 2/3	4 4/7	4 1/2
4 1/2	9	13 1/2	18	22 1/2	27	31 1/2	36	40 1/2
	9	6 3/4	6	5 5/8	5 2/5	5 1/4	5 1/7	5 1/16
5	10	15	20	25	30	35	40	45
	10	7 1/2	6 2/3	6 1/4	6	5 5/6	5 5/7	5 5/8
5 1/2	11	16 1/2	22	27 1/2	33	38 1/2	44	49 1/2
	11	8 1/4	7 1/3	6 7/8	6 3/5	6 5/12	6 2/7	6 3/16
6	12	18	24	30	36	42	48	54
	12	9	8	7 1/2	7 1/5	7	6 6/7	6 3/4
7	14	21	28	35	42	49	56	63
	14	10 1/2	9 1/3	8 3/4	8 2/5	8 1/6	8	7 7/8
8	16	24	32	40	48	56	64	72
	16	12	10 2/3	10	9 3/5	9 1/3	9 1/7	9
9	18	27	36	45	54	63	72	81
	18	13 1/2	12	11 1/4	10 4/5	10 1/2	10 2/7	10 1/8
10	20	30	40	50	60	70	80	90
	20	15	13 1/3	12 1/2	12	11 2/3	11 3/7	11 1/4
11	22	33	44	55	66	77	88	99
	22	16 1/2	14 2/3	13 3/4	13 1/5	12 5/6	12 4/7	12 3/8
12	24	36	48	60	72	84	96	108
	24	18	16	15	14 2/5	14	13 5/7	13 1/2

The table is used as follows:—Knowing the focal length of the lens to be used and the degree of (linear) enlargement or reduction, look up the figure for enlargement or reduction in the upper horizontal row, and carry the eye down the column below it until it reaches the horizontal line of figures opposite the focal length of lens in the left-hand column.

When *enlarging*, the greater of the two distances where the two lines join is the distance from lens to the sensitive paper or plate. The lesser is the distance from lens to negative, or picture being enlarged direct in camera.

When *reducing*, the distances are *vice-versâ*: the greater is the distance from lens to original, the smaller from lens to sensitive plate.

RELATIVE EXPOSURES WHEN ENLARGING (WITHOUT A CONDENSER).

New Times of Enlargement.	Times of enlargement for which exposure is known.											
	1	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12
1	1	2/3	2/5	1/3	1/4	1/5	1/6	1/9	1/12	1/20	1/30	1/40
1 1/2	1 1/2	1	3/4	1/2	2/5	1/3	1/4	1/6	1/8	1/12	1/20	1/30
2	2 1/4	1 1/2	1	3/4	3/5	2/5	1/3	1/4	1/5	1/9	1/12	1/20
2 1/2	3	2	1 1/4	1	3/4	3/5	1/2	1/3	1/4	1/6	1/10	1/15
3	4	2 1/2	1 4/5	1 1/4	1	3/4	2/3	2/5	1/3	1/5	1/8	1/11
3 1/2	5	3 1/2	2 1/4	1 3/4	1 1/4	1	4/5	1/2	2/5	1/4	1/6	1/9
4	6	4	3	2	1 1/2	1 1/4	1	3/4	1/2	1/3	1/5	1/7
5	9	6	4	3	2 1/4	1 3/4	1 1/2	1	3/4	2/5	1/3	1/5
6	12	8	5	4	3	2 1/2	2	1 1/4	1	3/5	2/5	2/7
8	20	13	9	7	5	4	3 1/2	2 1/4	1 3/4	1	2/3	1/2
10	30	19	13	10	7	6	5	3 1/2	2 1/2	1 1/2	1	3/4
12	42	27	19	14	11	8	7	4 1/2	3 1/2	2	1 1/2	1

To use this table find in the top horizontal line the number of times of enlargement for which exposure is known. Under this number the relative time of exposure for different degrees of enlargement will be found opposite the new times of enlargement in first vertical column.

RELATIVE EXPOSURES WHEN COPYING OR REDUCING.

New Scales of Reduction.	Scale of reduction for which exposure is known.											
	1	3/4	2/3	1/2	1/3	1/4	1/5	1/6	1/8	1/10	1/20	1/30
1	1	1 1/4	1 1/2	1 3/4	2 1/4	2 1/2	3	3	3	3 1/2	3 1/2	3 1/2
3/4	3/4	1	1 1/10	1 1/4	1 3/4	2	2	2 1/4	2 1/2	2 1/2	3	3
2/3	3/4	7/8	1	1 1/4	1 1/2	1 3/4	2	2	2 1/4	2 1/4	2 1/2	2 1/2
1/2	3/5	3/4	4/5	1	1 1/4	1 1/2	1 1/2	1 3/4	2	2	2	2
1/3	2/5	3/5	2/3	4/5	1	1 1/6	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 3/4
1/4	2/5	1/2	3/5	3/4	7/8	1	1	1 1/8	1 1/4	1 1/4	1 1/2	1 1/2
1/5	2/5	1/2	1/2	2/3	4/5	1	1	1	1 1/6	1 1/5	1 1/4	1 1/4
1/6	1/3	2/5	1/2	2/3	3/4	7/8	1	1	1	1 1/8	1 1/5	1 1/4
1/8	1/3	2/5	2/5	3/5	3/4	4/5	7/8	1	1	1	1 1/10	1 1/8
1/10	1/3	2/5	2/5	1/2	2/3	3/4	4/5	7/8	1	1	1	1 1/9
1/20	2/7	2/5	2/5	1/2	2/3	3/4	4/5	7/8	1	1	1	1
1/30	1/4	3/8	2/5	1/2	3/5	3/4	3/4	7/8	7/8	7/8	1	1

To use this table find in the top horizontal line the scale of reduction for which exposure is known. Under this scale the relative time of exposure for different degrees of reduction will be found opposite the new scales of reduction marked in first vertical column.

TABLE OF VIEW-ANGLES.

DIVIDE THE BASE* OF THE PLATE BY THE EQUIVALENT FOCUS OF THE LENS.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
0·282	16	0·748	41	1·3	66
0·3	17	0·768	42	1·32	67
0·317	18	0·788	43	1·36	68
0·335	19	0·808	44	1·375	69
0·353	20	0·828	45	1·4	70
0·37	21	0 849	46	1·427	71
0·389	22	0·87	47	1·45	72
0·407	23	0·89	48	1·48	73
0·425	24	0·911	49	1·5	74
0·443	25	0·933	50	1·53	75
0·462	26	0·954	51	1·56	76
0·48	27	0·975	52	1·59	77
0·5	28	1·0	53	1·62	78
0 517	29	1·02	54	1·649	79
0·536	30	1·041	55	1·678	80
0·555	31	1·063	56	1·7	81
0·573	32	1·086	57	1·739	82
0·592	33	1·108	58	1·769	83
0·611	34	1·132	59	1·8	84
0·631	35	1·155	60	1·833	85
0·65	36	1·178	61	1·865	86
0·67	37	1·2	62	1·898	87
0·689	38	1·225	63	1·931	88
0·708	39	1·25	64	1·965	89
0·728	40	1·274	65	2·0	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plate $3\frac{1}{4} \times 4\frac{1}{4}$.

Diagonal is 5·3 inches. $5·3 \div 13 = ·407$, corresponding with angle of 23°.

* More accurately the diagonal of the plate, inasmuch as the field of the lens is circular, and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate. The maker of a lens, stated to cover up to a given angle, may be asked if that angle is measured on the length or diagonal of a plate.

The lengths of the diagonals of the plates most commonly used are :—

$3\frac{1}{4} \times 3\frac{1}{4}$	diagonal 4·6 inches.		$7\frac{1}{2} \times 5$	diagonal	9·0 inches.
$3\frac{1}{4} \times 4\frac{1}{4}$	„ 5·3 „		$6\frac{1}{2} \times 8\frac{1}{2}$	„	10·7 „
5×4	„ 6·4 „		10×8	„	12·8 „
$4\frac{3}{4} \times 6\frac{1}{2}$	„ 8·0 „		12×10	„	15·6 „
7×5	„ 8·6 „		15×12	„	19·2 „

E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

Distance of Projection Lens from Screen, Mask being Three Inches.

Foci	4½		5		5½		6		7		8		9		10		11		12	14		15		16		18	
Disc.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	7	10½	8	9	9	7½	10	6	12	3	14	0	15	9	17	6	19	3	21	24	6	26	3	28	0	31	6
6	9	4½	10	5	11	5½	12	6	14	7	16	8	18	9	20	10	22	11	25	29	2	31	3	33	4	37	6
7	10	10½	12	1	13	3½	14	6	16	11	19	4	21	9	24	2	26	7	29	33	10	36	3	38	8	43	6
8	12	4½	13	9	15	1½	16	6	19	3	22	0	24	9	27	6	30	3	33	38	6	41	3	44	0	49	6
9	13	10½	15	5	16	11½	18	6	21	7	24	8	27	9	30	10	33	11	37	43	2	46	3	49	4	55	6
10	15	4½	17	1	18	9½	20	6	23	11	27	4	30	9	34	2	37	7	41	47	10	51	3	54	8	61	6
11	16	10½	18	9	20	7½	22	6	26	3	30	0	33	9	37	6	41	3	45	52	6	56	3	60	0	67	6
12	18	4½	20	5	22	5½	24	6	28	7	32	8	36	9	40	10	44	11	49	57	2	61	3	65	4	73	6
13	19	10½	22	1	24	3½	26	6	30	11	35	4	39	9	44	2	48	7	53	61	10	66	3	70	8	79	6
14	21	4½	23	9	26	1½	28	6	33	3	38	0	42	9	47	6	52	3	57	66	6	71	3	76	0	85	6
15	22	10½	25	5	27	11½	30	6	35	7	40	8	45	9	50	10	55	11	61	71	2	76	3	81	4	91	6
16	24	4½	27	1	29	9½	32	6	37	11	43	4	48	9	54	2	59	7	65	75	10	81	3	86	8	97	6
18	27	4½	30	5	33	5½	36	6	42	7	48	8	54	9	60	10	66	11	73	85	2	91	3	97	4	109	6
20	30	4½	33	9	37	1½	40	6	47	3	54	0	60	9	67	6	74	3	81	94	6	101	3	108	0	121	6
25	37	10½	42	1	46	3½	50	6	58	11	67	4	75	9	84	2	92	7	101	117	10	126	3	134	8	151	6
30	45	4½	50	5	55	5½	60	6	70	7	80	8	90	9	100	10	110	11	121	141	2	151	3	161	4	181	6
35	52	10½	58	9	64	7½	70	6	82	3	94	0	105	9	117	6	129	3	141	164	6	176	3	188	0	211	6
40	60	4½	67	1	73	9½	80	6	93	11	107	4	120	9	134	2	147	7	161	187	10	201	3	214	8	241	6
45	67	10½	75	5	82	11½	90	6	105	7	120	8	135	9	150	10	165	11	181	211	2	226	3	241	4	271	6
50	75	4½	83	9	92	1½	100	6	117	3	134	0	150	9	167	6	184	3	201	234	6	251	3	268	0	301	6

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS WHEN SHARP FOCUS IS SECURED ON INFINITY.

Focal length of Lens in inches.	Ratio marked on Stops.													
	f/4	f/5·6	f/6	f/7	f/8	f/10	f/11	f/15	f/16	f/20	f/22	f/32	f/44	f/64
	Number of feet after which all is in focus.													
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	6
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	29	27	22	20	13½	10	6½
7½	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	150	104	100	84	76	60	56	40	38	30	27	19	13½	9
8¾	156	111	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	131	113	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

If sharp focus is secured on any of the distances shown, then, with the stop indicated, all objects are in focus from half the distance focussed on up to infinity.

FOCAL LENGTH OF LENSES RECOMMENDED FOR STUDIOS OF VARIOUS LENGTHS.

The following table shows the focus of lens which is suitable for comfortable working in studios of various lengths. In each case it is assumed that 5 ft. of the length will be taken up by camera, operator, sitter and background. The figures in column 1 are the full run of the studio, including this 5 ft. In the case of the short studios the focal lengths are about the longest which can be used: in the case of the longer studios somewhat greater focal lengths might be used, but the lenses directed in the table are about the best for general work.

Length of Studio. Feet.	C.D.V. full length. Inches.	C.D.V. half length and Cabinet full length. Inches.	C.D.V. head, Cabinet half length. Inches.	Cabinet head and Boudoir full length. Inches.	Boudoir half length, Panel full length. Inches.	Boudoir head, Panel half length. Inches.
12	4*	6½*	8½	9*	12*	14
14	4¾*	7½*	9	10*	13*	16
16	5¾	8½	10	10½	16	18
18	6	8½	10½	10½	16	18
20	6	10	10½	12	18	20
22	7	10½	12	14	22	22
24	8½	12	14	16	24	24
28	8½	13½	16	16	24	24
30	10	13½	16	18	24	24

* Full lengths may be obtained with these focal lengths, but the standpoint is so near to the sitter that good perspective cannot be expected.

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

Equivalent Focus (inches).	Heights of Images (inches).																	
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47·3 2·1	36·0 2·1														
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3													
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5												
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7											
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2									
7	483·0 7·0	245·0 7·1	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6								
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4							
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6							
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1					
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2				
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6				
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6			

Values are omitted here on account of the wide angle of space required. (More than ninety degrees.)

14	996·0 14·2	490·0 14·4	331·3 14·6	252·0 14·8	172·7 15·2	133·0 15·6	109·2 16·1	93·3 16·5	82·0 16·9	73·5 17·3	61·6 18·0	53·7 18·9	48·0 19·8	43·7 20·6	37·8 22·2			
16	1104 16·2	560·0 16·5	378·7 16·7	288·0 16·9	197·3 17·4	152·0 17·9	124·8 18·4	106·7 18·8	93·7 19·3	84·0 19·8	70·4 20·7	61·3 21·6	54·9 22·6	50·0 23·5	43·2 25·4	38·7 27·3	35·4 29·2	
18	1242 18·3	630·0 18·5	426·0 18·8	324·0 19·1	222·0 19·6	171·0 20·1	140·4 20·6	120·0 21·2	105·4 21·7	94·5 22·2	79·2 23·3	69·0 24·4	61·7 25·4	56·2 26·5	48·6 28·6	43·5 30·7	39·9 32·8	36·0 36·0
20	1380 20·3	700·0 20·6	473·3 20·9	360·0 21·2	246·7 21·8	199·0 22·4	156·0 22·9	133·3 23·5	117·1 24·1	105·0 24·7	88·0 25·9	76·7 27·1	68·6 28·2	62·5 29·4	54·0 31·8	48·3 34·1	44·3 36·5	40·0 40·0
22	1518 22·3	770·0 22·6	520·7 23·0	396·0 23·3	271·3 23·9	209·0 24·6	171·6 25·2	146·7 25·9	128·9 26·5	115·5 27·2	96·8 28·5	84·3 29·8	75·4 31·1	68·7 32·4	59·4 35·9	53·2 37·6	48·7 40·1	44·0 44·0
24	1656 24·4	840·0 24·7	568·0 25·1	432·0 25·4	296·0 26·1	228·0 26·8	187·2 27·5	160·0 28·2	140·6 28·9	126·0 29·6	105·6 31·1	92·0 32·5	82·3 33 9	75 0 35·3	64·8 38·1	58·0 40·9	53·1 43·8	48·0 48·0
26	1794 26·4	910·0 26·8	615·3 27·1	468·0 27·5	320·6 28·3	247·0 29·0	202·8 29·8	173·3 30·6	152·3 31·3	136·5 32·1	114·4 33·6	99·7 35·2	89·1 36·7	81·2 38·2	70·2 41·3	62·8 44·4	57·6 47·4	52·0 52·0
28	1932 28·4	980·0 28·8	662·7 29·2	504·0 29·6	345·3 30·5	266·0 31·3	218·4 32·1	186·7 32·9	164·0 33·8	147·0 34·6	123·2 36·2	107·3 37·9	96·0 39·5	87·5 41·2	75·6 44·5	67·7 47·8	62·0 51·1	56·0 56·0
32	2208 32·5	1120 32·9	757·3 33·4	576·0 33·9	394·7 34·8	304·0 35·8	249·6 36·7	213·3 37·6	187·4 38·6	168·0 39·5	140·8 41·4	122·7 43·3	109·7 45·2	100·0 47·1	86·4 50·8	77·3 54·6	70·9 58·4	64·0 64·0
36	2484 36·5	1260 37·1	852·0 37·6	648·0 38·1	444·0 39·2	342·0 40·2	280·8 41·3	240·0 42·4	210·9 43·4	189·0 44·5	158·4 46·5	138·0 48·7	123·4 50·8	112·5 52·9	97·2 57·2	87·0 61·4	79·7 65·6	72·0 72·0
44	3036 44·6	1540 45·3	1041 45·9	792·0 46·7	542·7 47·9	418·0 49·2	343·2 50·5	293·3 51·8	257·7 53·1	231·0 54·3	193·6 56·9	168·7 59·6	150·9 62·1	137·5 64·7	118·8 69·9	106·3 75·1	97·4 80·2	88·0 88·0
52	3588 52·8	1820 53·5	1231 54·3	936·0 55·1	641·3 56·6	494·0 58·1	405·6 59·6	346·7 61·2	304·6 62·7	273·0 64·2	228·8 67·3	199·3 70·4	178·3 73·4	162·5 76·5	140·4 82·6	125·7 88·7	115·1 94·8	104·0 104·0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distance from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15·6 inches.

TABLES IN PAST ISSUES OF THE ALMANAC.

The following is a list of tables which have appeared in past issues of the "Almanac," but are not included among those in the present volume.

The reference in brackets after each is to the most recent issue of the "Almanac" in which the table has appeared; in most cases it will be found included for several years prior to the date of this reference.

Chemical Tables.

Weights and Measures Act. ["B.J.A." 1905, p. 1012.]

Simplification of Emulsion Calculations. (Equivalence of Alkaline Haloid Salts.) ["B.J.A." 1903, p. 1160.]

Solubility of the Silver Haloids—Valenta. ["B.J.A." 1907, p. 1109.]

Freezing Mixtures. ["B.J.A." 1907, p. 1116.]

Chemical Equivalence of the Alkalies. ["B.J.A." 1903, p. 1159.]

Developing Equivalence of the Alkalies. ["B.J.A." 1903, p. 1159.]

Chemical Reactions of the known Developing Agents (Tests of Developers). ["B.J.A." 1904, p. 1010.]

Pyro Developers recommended for various Plates by Makers. ["B.J.A." 1890, p. 666.]

Tables of Developers (in grains per oz.) for Various Commercial Plates. ["B.J.A." 1912, p. 761.]

Orthochromatic Data.

Speeds and Colour Sensitiveness of Various Plates to Different Lights.—Eder. ["B.J.A." 1907, p. 1115.]

Wave-Lengths of the Principal Fraunhofer Spectrum Lines, and the Elements that give them ["B.J.A." 1905, p. 1144.]

Reflection of Light from various surfaces. ["B.J.A." 1900, p. 1016.]

Light and Exposure.

Hourly Variation in the Sun's Position in Degrees from the South at Different Seasons of the Year.—J. A. C. Branfil. ["B.J.A." 1903, p. 1176.]

Points of the Compass at which the Sun rises for London, Edinburgh, and Dublin. ["B.J.A." 1869, p. 147.]

Sun's Altitude for various Latitudes. ["B.J.A." 1898, p. 1063]

Exposure and Lens Aperture. ["B.J.A." 1910, p. 893.]

Actinograph Exposure Table. ["B.J.A." 1901, p. 702.]

Comparative Exposures.—W. K. Burton. ["B.J.A." 1887, p. 341.]

Comparative Exposures.—Dr. Scott. ["B.J.A." 1887, p. 432.]

Displacement on Ground Glass of Objects in Motion. ["B.J.A." 1903, p. 1180.]

Comparative Plate-speed Numbers. ["B.J.A." 1912, p. 897.]

Optical Tables.

Equations relating to Foci, etc.—Branfil. ["B.J.A." 1907, p. 1120.]

Depth of Field.—Formulæ. ["B.J.A." 1910, p. 894.]

Combining Lenses.—Formulæ. ["B.J.A." 1910, p. 893.]

Perspective—Factors. ["B.J.A." 1910, p. 895.]

Correction of Convergent Distortion.—Formulæ. ["B.J.A." 1910, p. 896.]

Scale of Image.—Formulæ. ["B.J.A." 1910, p. 893.]

Conjugate Foci.—Formulæ. ["B.J.A." 1910, p. 892.]

Minimum Length of Studio for a given Lens. ["B.J.A." 1905, p. 998.]

Royal Photographic Society's Standard Diaphragms. ["B.J.A." 1903, p. 1178; 1905, p. 1149; and 1907, p. 1093.]

"Uniform System" Numbers for Stops from f/1 to f/100. ["B.J.A." 1905, p. 1147.]

Continental Stops and their U.S. Equivalents. ["B.J.A." 1907, p. 1127.]

Correction for Inconstancy of Aperture—Formulæ. ["B.J.A." 1910, p 895]

Angles and Foci of the Tele-Photo Lens. ["B.J.A." 1894, p. 949.]

Steinheil's Table of Camera Extensions, Equivalent Foci and Diameters of Images corresponding to a given Magnification of the Tele-Photographic Lens. ["B.J.A." 1902, p. 732.]

Focussing with Pinhole Apertures. ["B.J.A." 1896, p. 954.]